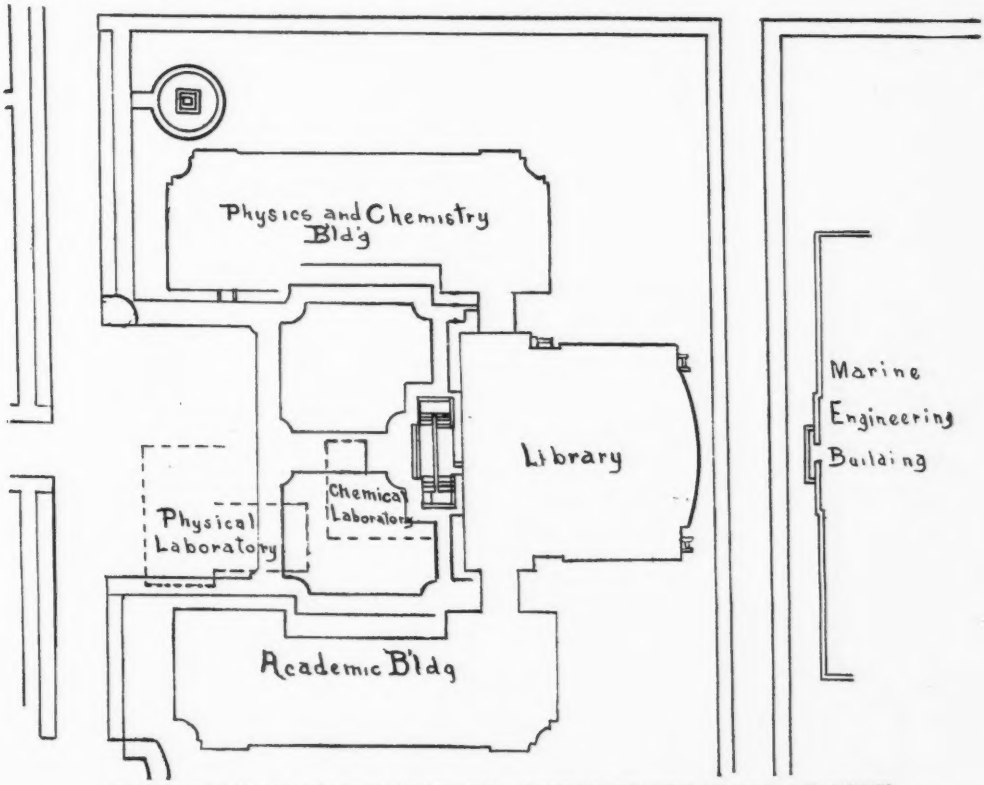
THE HEATING AND VENTILATING MAGAZINE

1123 BROADWAY NEW YORK OCTOBER, 1907

Heating and Ventilating the United States Naval Academy

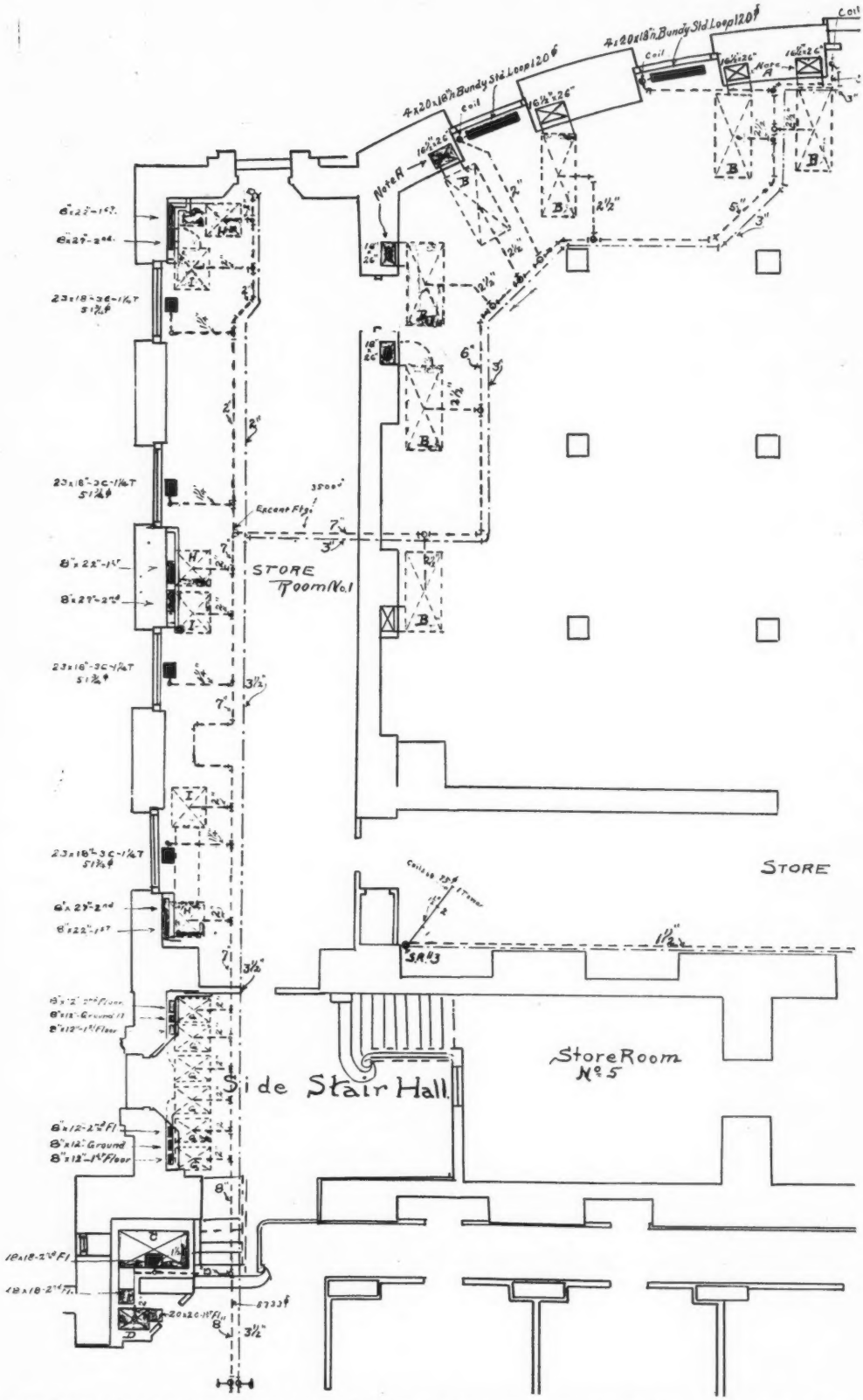
Showing Method of Ventilating Lecture Halls Having Stepped Floors

In the construction of the New United States Naval Academy at Annapolis, Md., three of the new buildings form what is known as the Academic Group. They include the Library in the center with the Academic Building on one side and the Physics and Chemistry Building on the other. The Academic and Physics and Chemistry Buildings are of similar shape. The three buildings are connected so as to form a continuous structure and in their equipment they are considered practically as one. The connecting links contain corridors, etc., and together the buildings form three sides of a central court.



BLOCK PLAN OF ACADEMIC GROUP, UNITED STATES NAVAL ACADEMY

The Academic and Library Buildings have pile and concrete foundations and the Physics and Chemistry Building a concrete foundation directly on the soil. All three buildings are of fire-proof construction through-



PORTION OF GROUND FLOOR PLAN, LIBRARY BUILDING, SHOWING LOCATION AND ARRANGEMENT OF INDIRECT HEATING STACKS

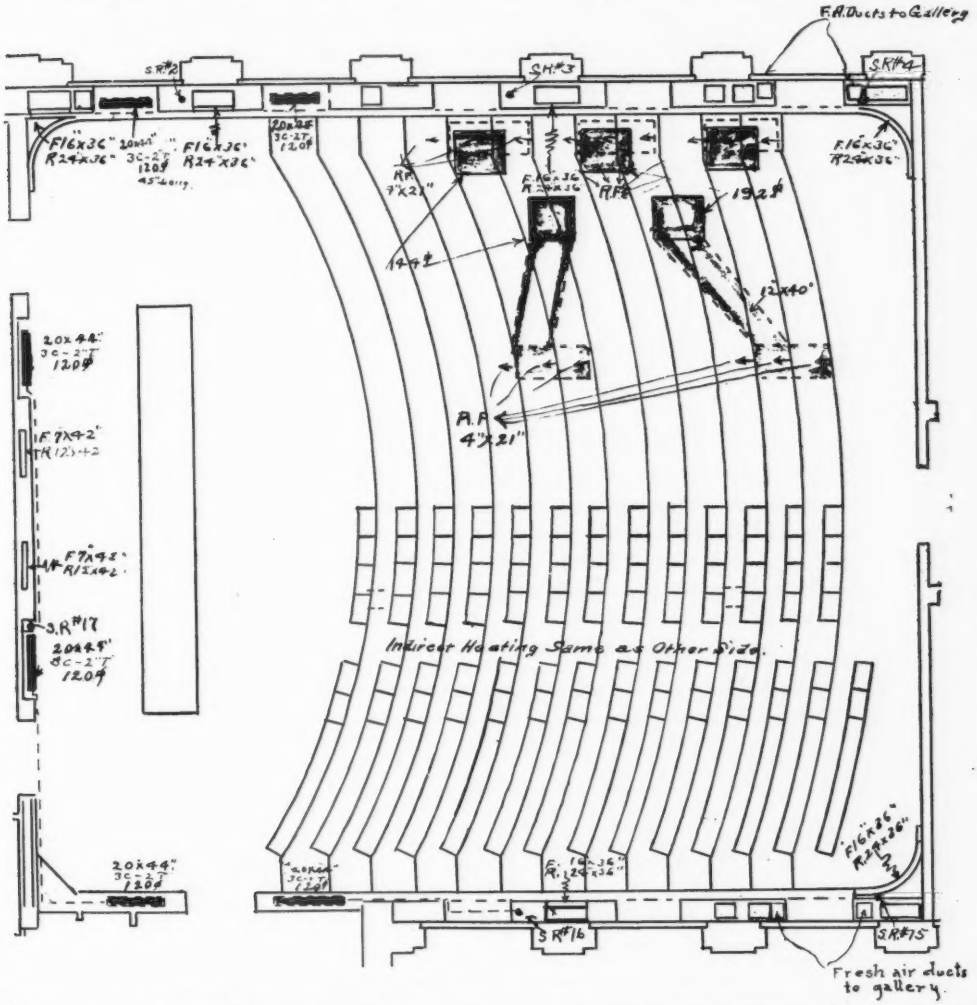
out, with brick and granite exterior, and slate, tile and copper roofing. The Library Building is surmounted by an observatory and clock tower. In general, the exterior walls and some interior walls are furred out and lathed with metal for heat and vent ducts and decorative features.

WORK INCLUDED IN HEATING AND VENTILATING SYSTEM

The work included in the heating and ventilating system covers, in addition to the apparatus required for a direct and indirect heating system, a special high pressure steam system for the Physics and Chemistry Building; also ventilating ducts and flues and exhaust fans for all three buildings. The steam heating system is a low pressure, gravity return, with one pipe risers for supply and return and separate supply and return mains located in trenches, all fitted with air valves, but without air piping. The piping is arranged so that the Warren Webster vacuum system can be added, if desired, by putting in return risers and connections.

EQUIPMENT OF BUILDINGS

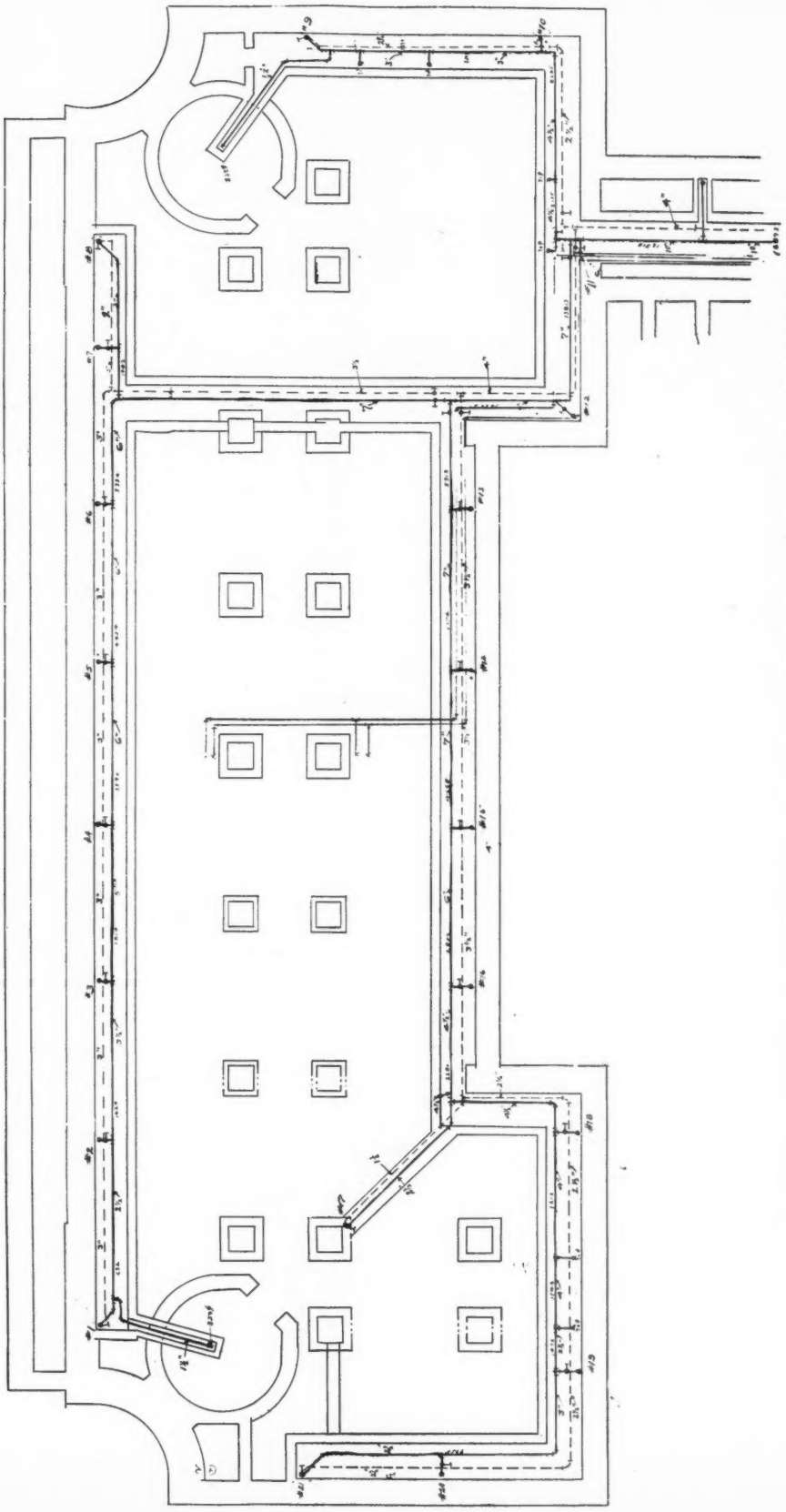
In the equipment of the Academic Building all radiators on the ground



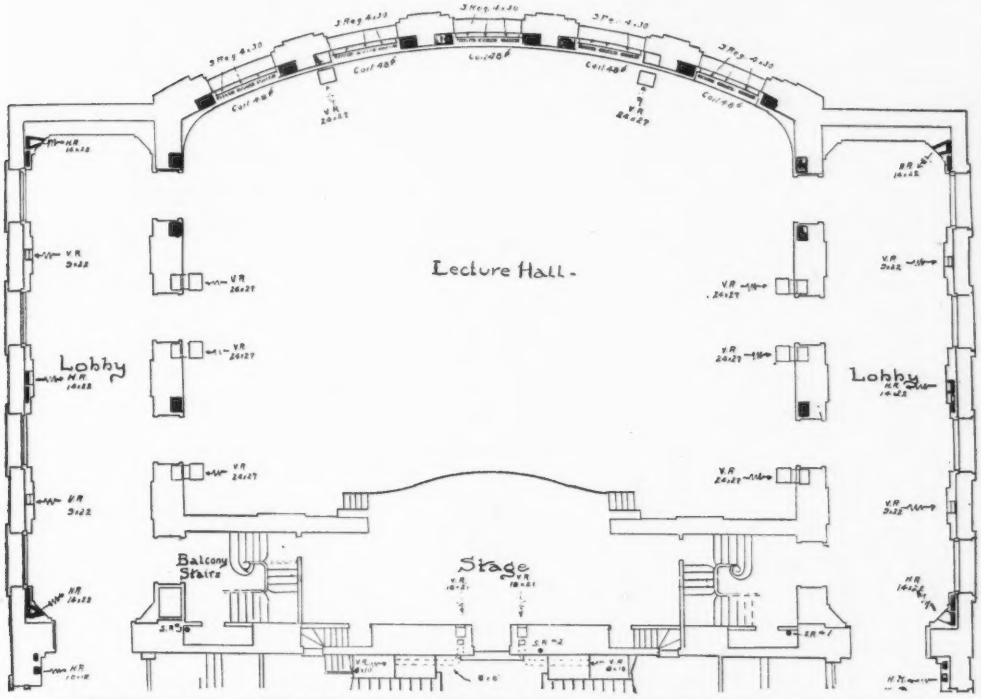
LECTURE HALL, PHYSICS AND CHEMISTRY BUILDING, SHOWING METHOD OF ADMITTING WARM AIR THROUGH STEPPED FLOOR

floor under windows are box-base, with direct radiators only in corridors and stair hall. All the radiators on the first, second and third floors are box-base, with the exception of those in one room on the second floor.

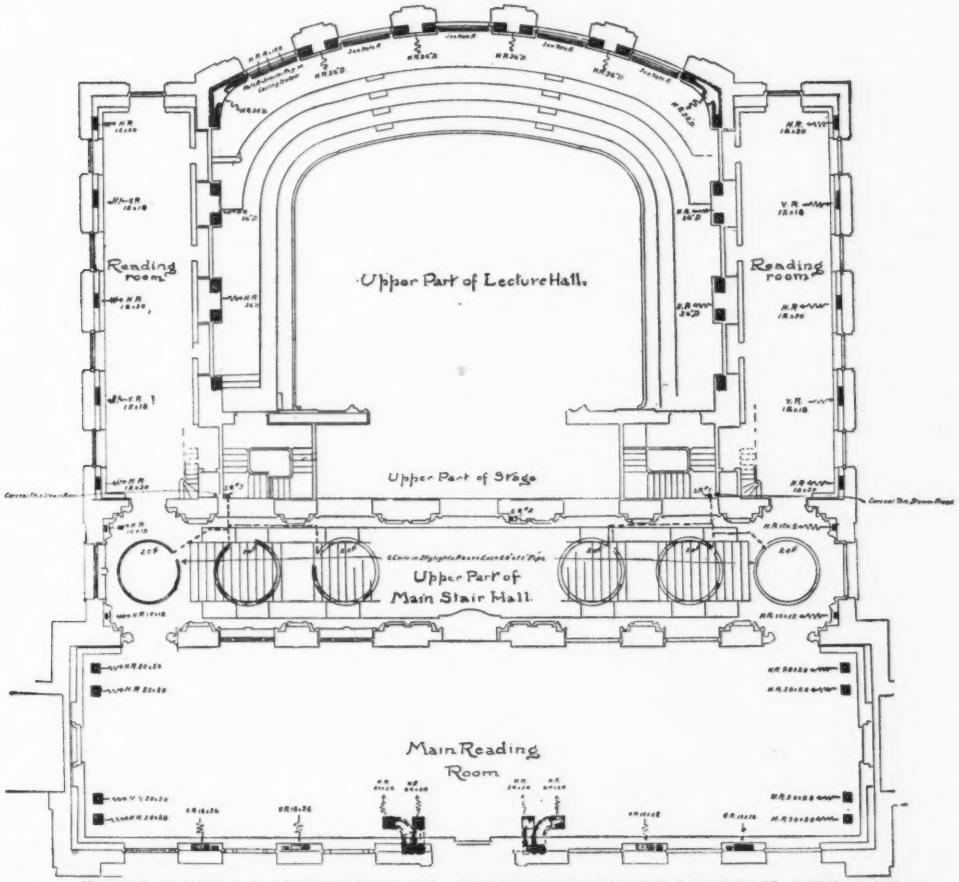
The Physics and Chemistry Building is similarly equipped except that on the second floor indirect radiators



CELLAR PLAN, PHYSICS AND CHEMISTRY BUILDING, SHOWING STEAM MAINS LAID IN TRENCHES



LECTURE HALL, LIBRARY BUILDING, HEATED AND VENTILATED BY INDIRECT RADIATION



UPPER PART OF LECTURE HALL, SECOND FLOOR OF LIBRARY BUILDING

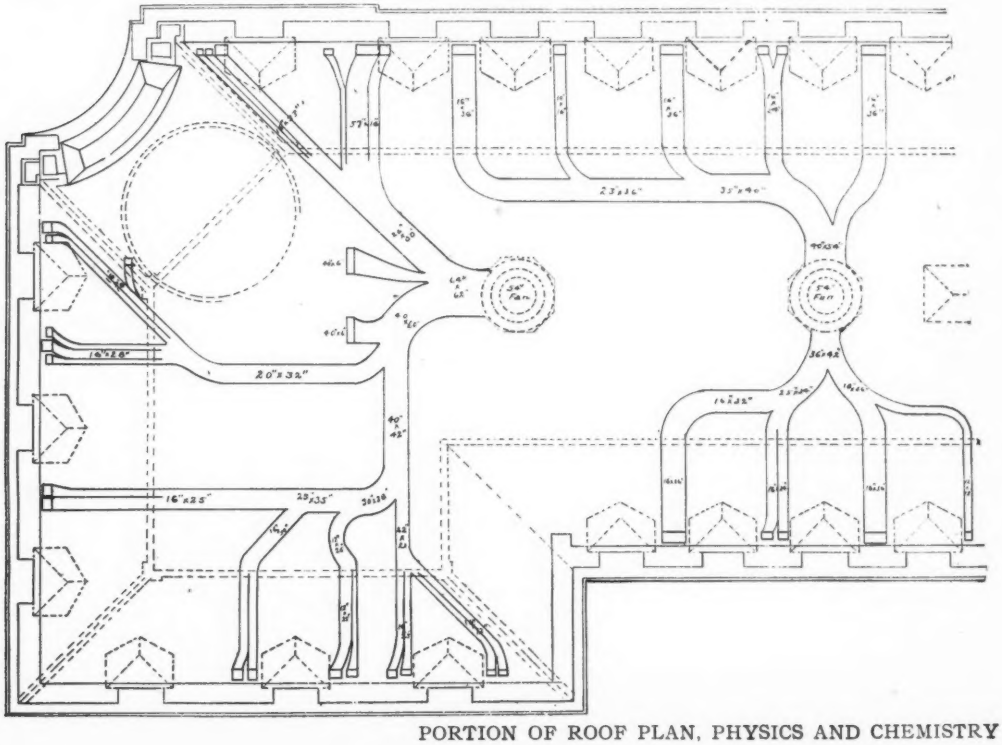
are installed under the stepped floor in the lecture hall. All the remaining radiation on this floor is box-base, with one or two exceptions. On the third floor indirect radiation is placed in the gallery of the lecture hall, the remaining radiation on this floor being mainly box-base.

In the Library Building direct radiators are used on the ground floor for the halls and offices; indirect radiators for the side stair halls, and directs for the three storerooms on this floor. On the first floor, indirect radiators are used in the Trophy Hall, side stair halls and lobbies. In the Lecture Hall there are window coils placed behind screens. The radiators on the second floor are all indirect; skylight coils are located over the main stair hall on the second floor ceiling. The first, second and upper tower floors of this building are equipped with direct radiation except in one room on the first floor where there are box-base (direct-indirect) radiators. There is also a skylight coil in the vestibule on this floor.

In the front part of the Library Building on the ground floor heating chambers are constructed in the two corners of the two halls adjoining offices Nos. 1 and 4. These chambers contain the indirect radiators for the Trophy Hall and for the main reading-room. Some of them are double or in two banks to save space. Each chamber has a fresh air intake through the side wall from which galvanized iron cold air ducts extend to the stacks.

In storeroom No. 8, in the front of the ground floor of the Library, the stacks for the front part of the Trophy Hall and reading-room are located above the ground floor near the ceiling, with the fresh-air intake leading from a passage underneath the main entrance stairs.

Trenches under the ground floor, as shown on the plans, contain the indirect radiator stacks, with twelve fresh-air intakes leading to the side stair halls and storerooms Nos. 1, 2 and 3. The indirect radiators in the trenches in storeroom No. 2 of the Library are made up of three-barrel sections, also those in storeroom No. 8 and halls adjoining offices No. 1 and 4. The rest are two-barrel sections.



PORTION OF ROOF PLAN, PHYSICS AND CHEMISTRY

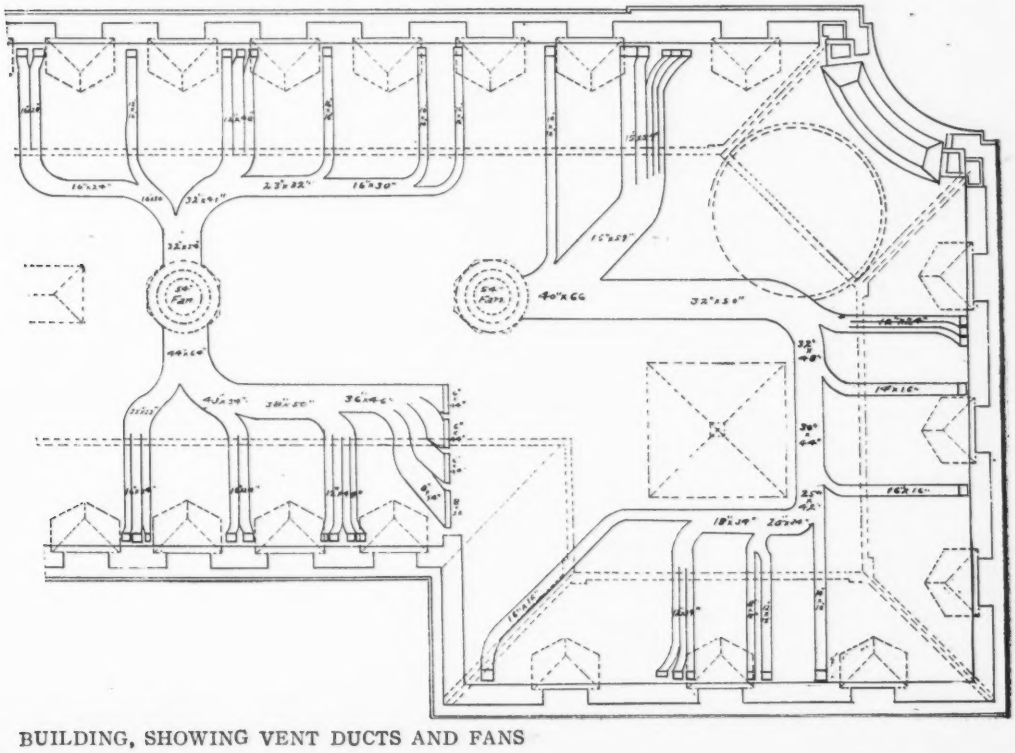
In the rear part of the Library the cold-air ducts, like the radiators themselves, are located in trenches under the ground floor. The hot-air flues in the Lecture Hall are combined in pairs, two discharging through one round register.

The heating of the lecture-room in the Physics and Chemistry Building is accomplished by ten stacks of indirect radiators located under the tiers of seats above the second floor and four stacks in the gallery, at the third floor level. The ten second-floor stacks take fresh air from six inlets located in the granite panels under the sills of large windows and each stack discharges the hot air through registers on the risers of the aisle steps, making thirty registers for the ten stacks which are connected to their inlets and to the hot-air registers by means of galvanized iron ducts with by-passes for thermostatically controlled mixing dampers.

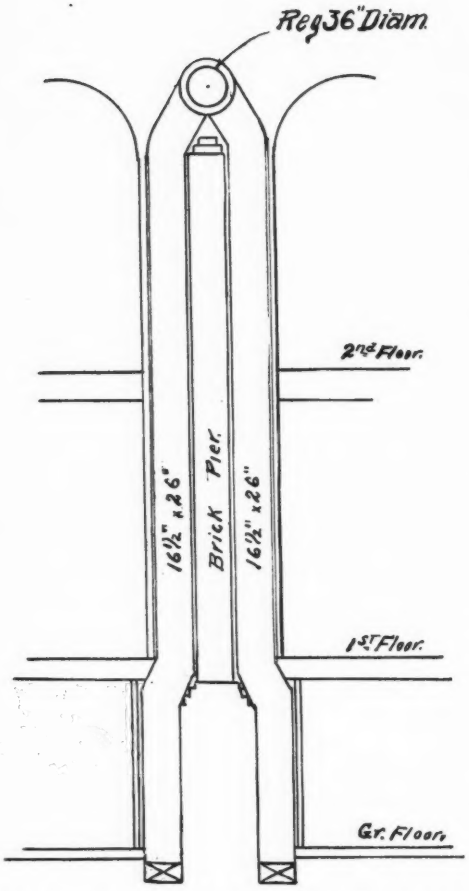
The gallery stacks on the third floor take fresh air from inlets located on both sides of two large windows. The side sashes of these two windows are fitted with fine mesh wire screens. Galvanized iron ducts are run back of them in the furring up to the gallery and in the latter over to the stacks. The ducts from both sides of each window are united over the top of the window. Each of these four stacks again discharges through three registers in the risers of the aisles, making twelve registers in all. The duct work and mixing dampers are the same as for the second floor stacks. Access is had to the spaces under the seats on the main floor and in the gallery by means of doors. In this building the cold air ducts are located in the spaces under the seats and in the wall furring. The hot-air flues in the lecture room are of special design, with an outlet from each stack branching to three registers.

HEATING SUPPLY AND RETURN MAINS

Starting at the point where the pipe tunnel intersects with this group of buildings (between the Library and Academic wing) heating supply and return mains are run through the buildings in trenches, as indicated on the plans. Steam is furnished by a power house located on the Academy grounds.



BUILDING, SHOWING VENT DUCTS AND FANS



DETAIL OF FLUE CONSTRUCTION, NAVAL ACADEMY BUILDINGS

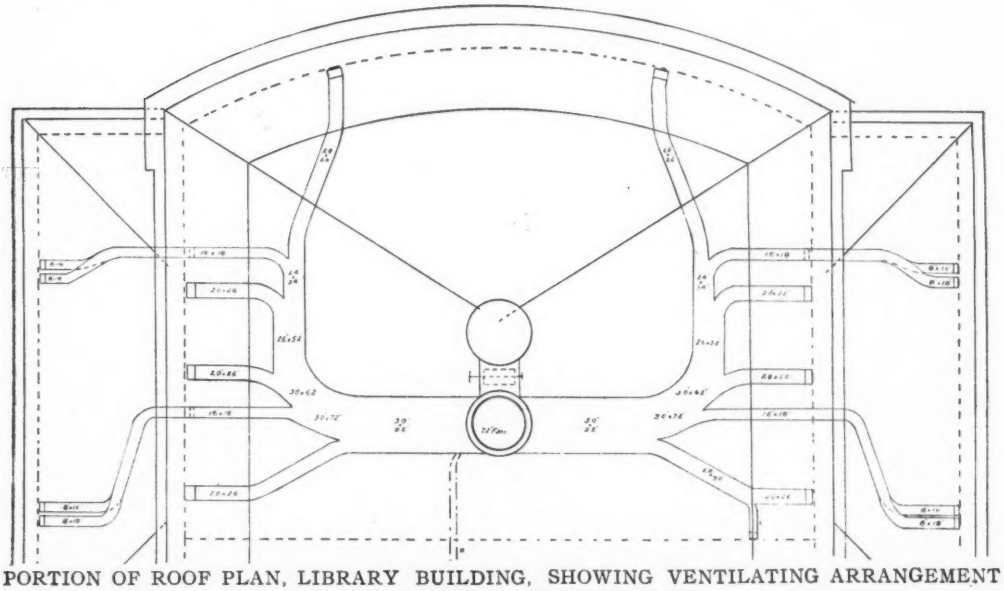
SPECIAL STEAM CONNECTIONS, PHYSICS AND CHEMISTRY BUILDING

A high-pressure steam system (about 40 lbs.) runs through this building, starting at the mouth of the pipe tunnel (between the Library and Academic buildings) and extends thence through the trenches and up in the chases and furred walls with branches for experimental purposes leading to several rooms in this building, which contain apparatus used by the students, including tables and hoods. In Room 2 of this building is located an 8x10x15-inch Cameron vacuum and air pump and there is also run into this room a high pressure steam supply (equivalent to about 100 horse power) for operating additional engines that may be located there in the future.

GENERAL DESCRIPTION OF VENTILATION.

The Academic Building is ventilated by galvanized iron flues from the various rooms extending up in the wall furring to the loft-space under the roof. There the flues are connected into large ducts running into four exhaust chambers, each containing a 48-inch fan.

The Library and the Trophy Hall, first floor, and the reading-room, second floor, are ventilated by ducts running to a 48-inch fan located in



PORTION OF ROOF PLAN, LIBRARY BUILDING, SHOWING VENTILATING ARRANGEMENT ABOVE CEILING OF LECTURE HALL

the roof-dormer over main reading room. The lower part of the stage storerooms back of the reading-room and stairs on sides of same are ventilated downward by a 30-inch fan located in the shaft in storeroom No. 2, ground floor, discharging into an area. The side stairs communicate with the stage through double partition registers. The Lecture Hall, the lobbies on each side, the reading-room over the lobbies, the Naval Institute Room in tower and the librarian's room adjoining the reading-room are all ventilated by ducts running to a 72-inch fan located in loft over the Lecture Hall. The Lecture Hall also has a circular ceiling register, connected to an exhaust fan for additional ventilation during the summer. The stage ceiling is similarly vented at top of roof for summer ventilation.

The ventilation of the Physics and Chemistry Building is similar to that of the Academic Building, except that the four exhaust fans are 54 inches.

The architect of the Naval Academy group is Mr. Ernest Flagg, of New York, and the builders, the John Peirce Co., New York. The heating and ventilating equipment was installed by the New York Steam Fitting Co., New York.

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*Another Aid to the Ventilating Engineer: A Recording Anemometer**

Awarded First Prize in the Assistants' Prize Competition

By J. Roger Preston

I suppose most of you have a certain amount of testing to do in connection with the velocity of air under varying conditions, and realize sometimes very forcibly now inconvenient the ordinary anemometer or air meter may be.

Let us take an instance. Supposing you are called in to give an opinion on the ventilation of a large hall. You understand that the ventilation is not very bad, but still unsatisfactory. On arriving you find there are two fans, one in the extract shaft and one in connection with the inlets, the conditions generally are very variable, there being several doors and windows which may be open or shut under normal conditions, according to the eccentricities of the occupants.

There appears to be a fair amount of air passing through the shafts, so that before giving an opinion you are wishful to obtain all the data you possibly can within a reasonable time. I say reasonable, because many people, and public bodies, too, seem to think that an engineer can walk into a building, the ventilation of which is defective, and tell at a glance what is the matter, though they could not make a bigger mistake.

DATA REQUIRED IN TEST OF VENTILATING SYSTEM

In connection with the C O and other tests you will desire to know the amount of air passing through the various shafts, and how it is affected by varying conditions.

You think the matter over and decide you would like the following data:

The amount of air passing through extract shaft with extract fan going, window shut, door shut; same but with inlet fan stopped; same but with extract fan stopped; same but with door open; same but with windows open.

You may require the inlet fan running with all the doors and windows open, or the extract fan only running, with the doors and windows open, and many other tests which would suggest themselves to your mind.

METHOD OF PROCEDURE WITH ORDINARY ANEMOMETER

Let us assume you are going to carry out the above with an ordinary air meter; what you have to do is something like this:

Open the shaft, take the reading of

*Read at the meeting of the British Institution of Heating and Ventilating Engineers, London, England, October 8, 1907.

the meter, place meter inside the shaft, keeping your finger on the starting catch till your watch gets to some definite time, start meter and close the opening in the shaft quickly, so as to get the most correct

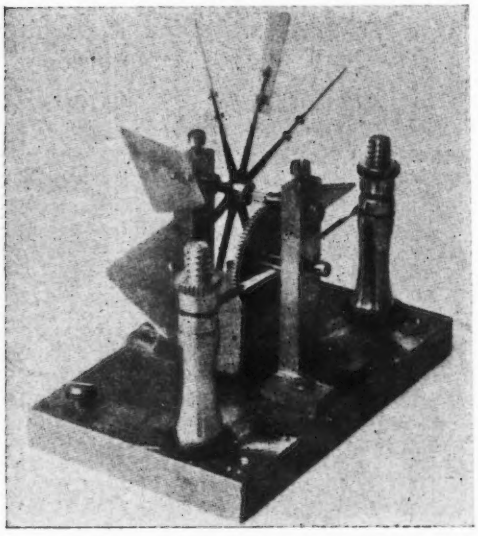


FIG. 1—VIEW OF ANEMOMETER

reading you can. After waiting a predetermined time, you again open the shaft and make a dive with your finger for the catch, so as to get the meter stopped, the opening in the shaft, owing to the inrush of air, affecting the reading. This shaft probably will be dark inside, and in your hurry you will find in practice your finger in contact with the vanes at first, instead of the catch, which, obviously, won't improve the working of the instrument. You now withdraw the meter, take the reading, subtracting the previous reading, without it is of the zero setting type. You next tramp downstairs and stop the inlet fan, climb the stairs again. This performance will have to be gone through for every single test.

Very much of this, especially if it is a long way from one point to another, is calculated to try the patience of most men, however anxious they may be to get sufficient data, and any of us who have had testing to do must realize how very easy it is to make mistakes, either in the reading of the meter or the time, however careful we may be; at least when we get home, and the readings worked out, we sometimes find rather surprising results, and then we wonder whether we have taken every reading quite correctly.

It was to overcome these difficulties that caused me to give the subject

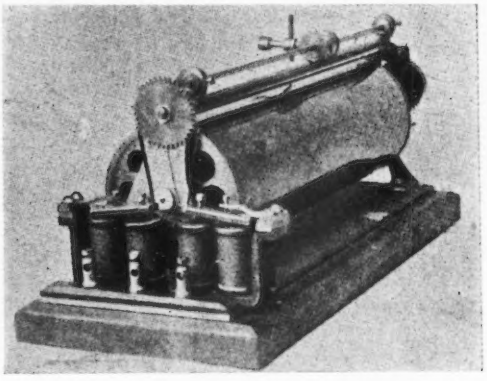


FIG. 3—RECORDING APPARATUS

consideration about two months ago, and to set about to devise some method of overcoming them. I settled in

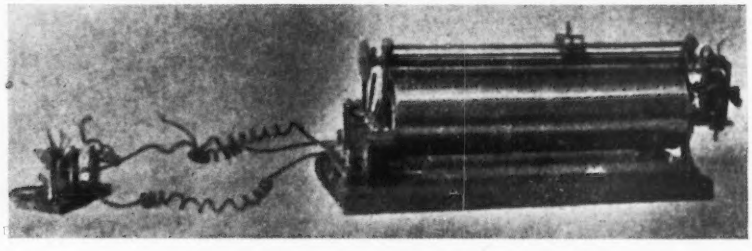


FIG. 2—ANEMOMETER ATTACHED TO RECORDER

my own mind the arrangement, to be of practical use, must have the following points:

DESCRIPTION OF NEW RECORDING ANEMOMETER

It must be of a type recording the

time, velocity of air passing and the direction of same, the recording part to be outside the shaft, have no very delicate mechanism to get out of order or difficult to repair, portable, and reasonable in cost.

After describing the instrument, and explaining the diagrams taken direct of the drum, I will endeavor to show how the foregoing tests men-

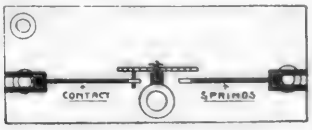


FIG. 4

tioned could be carried out with correctness and a minimum of labor.

The number of revolutions and direction made by similar vanes to those used in the ordinary air meter are transmitted electrically to a carriage carrying a pencil or pen over a drum revolving once round in a predetermined time by clockwork, this carriage traveling along the drum in proportion to the speed of the vanes, and backward or forward, according to the direction in which the vanes are traveling.

Figs. 1 and 2 show the transmitting apparatus itself, also coupled to the recording apparatus, while Fig. 3 is a view of the recording apparatus. The study of these photos will give a general idea of the apparatus, and enable the sketches to be more easily followed.

You will notice the photograph of the transmitting apparatus does not quite agree in detail with the sketches. This is due to it being made of whatever was handy. I may say that, apart from the actual vanes, the making was all done in our own shops by an intelligent apprentice, with the assistance of a local watchmaker for the delicate parts, such as pivoting the vanes, etc. Fig. 6 is a plan of the recording apparatus, which I will explain first.

DESCRIPTION OF RECORDER

A is a base plate on which the standards *B* and *C* are fixed; *D* is a drum or cylinder with pivots which revolve in the standards *B* and *C*. This drum is connected with the clock *E*, which causes it to revolve once in ten minutes; this is arranged by

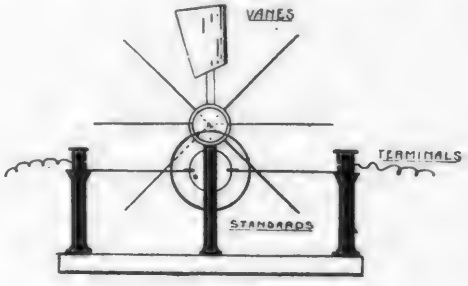


FIG. 5

having a wheel on the minute spindle geared into another fastened on to the drum spindle in a ratio of one in six. Over this drum is a traversing carriage, *F*, which slides on a guide spindle, *G*. The carriage is screwed at *H* for part of its length, and engaged with the shaft *I*, which is screwed the whole length between

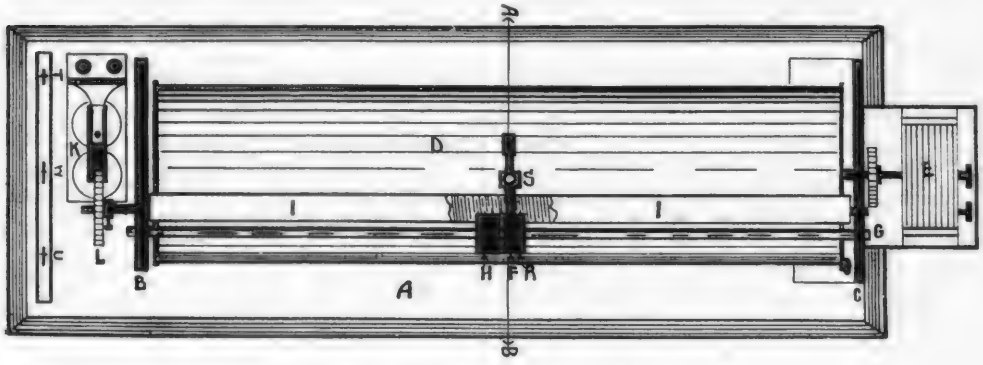


FIG. 6—PLAN OF RECORDER

the standards, 20 threads to the inch.

The shaft is free to revolve in the standards, motion being given to it by the electric magnets, *K*, of which an elevation is given on Fig. 8. The wheel, *L*, which is fastened to shaft, *I*, has 40 teeth in its circumference. *ZZ*, Figure 7, are pieces of wire fastened to the springs, *H*, shown in elevation, and are so arranged as to trip over the teeth of the wheel one way, but push it forward the other way.

Let us assume that a current is sent through the left-hand magnet, the armature is drawn down, and at the same time the wire, *Z*, at the end of spring, *H*, has been tripped over a tooth of the wheel, *L*. On the current being cut off the armature is sprung back to its original position by the spring, the wire, *Z*, rising at the same time and pushing up a tooth before it, thereby revolving the toothed wheel in a right-hand direction 1-40 of a revolution.

Assuming that a current was sent through the right-hand magnet, it will be readily seen that the wheel will be revolved the same distance to the left hand.

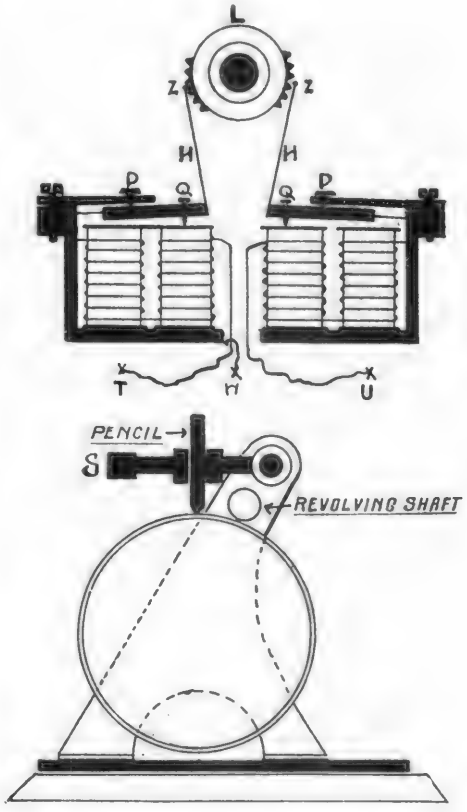
One important point is that wires *Z*, when in their normal state, should stand just clear of the teeth, so as to allow the wheel to go either way.

PP and *QQ* are regulating screws.

Referring again to the carriage *F*, Fig. 6, it is shouldered down at *R*, the pencil holder or pen revolving upon it, a section of which is shown, Fig. 8. The pencil is pressed upon the drum by the weight of its holder, *S*. We have now seen how the motion may be transmitted from the magnets to the carriage carrying the pencil, which, in its turn, marks the paper which may be wound round the drum.

We also notice that by sending the current through the left-hand magnet the shaft *I* revolves to the right, carrying the pencil towards the standard *B*, but by diverting the current through the right-hand magnet, the shaft is turned to the left, and the pencil carried towards the standard *C*. The magnets are wound as shown, Fig. 7, the beginning end of each being fastened to the metal frame, the other ends to the terminals, *T* and *U*, respectively, *W* making contact with the metal frame. The terminals are fastened on a hardwood strip, as shown.

The arrangement of vanes and contacts on the transmitting apparatus is very simple; the vanes are fastened to a shaft which is pivoted between two standards, as will be seen from



FIGS. 7 AND 8

the photograph, Fig. 1, the shaft carrying a small-toothed wheel geared into a larger one in ratio of one to ten; on the larger wheel is a platinum pin shown in the photograph and in section Fig. 5.

When the vanes are in motion the wheel carrying this pin revolves once round for every ten revolutions of the vanes, the pin coming into contact with the springs which are fastened to the terminals as shown. These springs are covered on the top side with paper or other insulating mate-

rial, so that the pin only makes contact with the metallic part of the spring when coming from underneath. It will be obvious, therefore, that if the vanes are traveling to the right hand, the large wheel, owing to the gearing of same, will be traveling to the left, the platinum pin making contact only with the underside of the right-hand spring. If the direction of the vanes is reversed, the pin will only make contact with the underside of the left-hand spring.

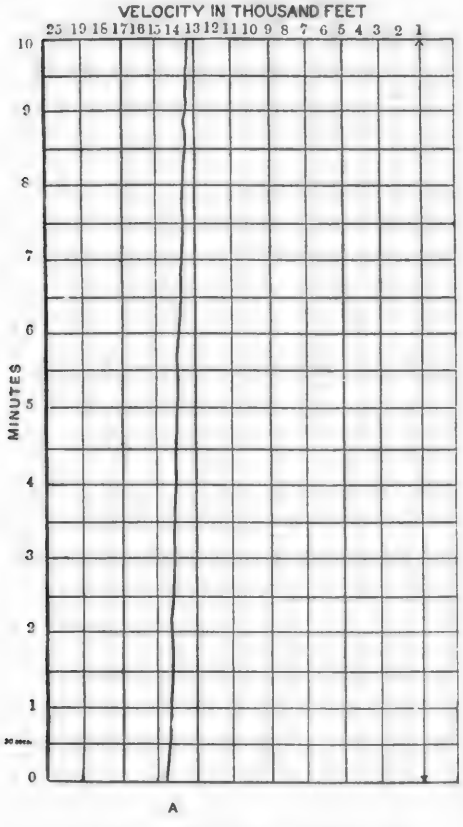


DIAGRAM OF PAPER TAKEN OFF RECORDER

It is obvious, therefore, that the current can be diverted through either terminal, according to the direction of the vanes, and that by connecting these two terminals to the two outside terminals on the recorder, the magnets are controlled by the direction in which the vanes are traveling.

Fig. 2 shows the transmitter connected up to the recorder, the two pillar terminals on the transmitter being connected with the two outside terminals on the recorder, the small terminal on the transmitter and the center terminal on the recorder going to the batteries, which are not shown. It is intended for the whole apparatus to fit into a box with dry cells underneath. I may say that the magnets take very little current. A small switch will be desirable between the recorder and transmitter, so that the magnet can readily be put in and out of action.

The paper which is wound round the drum may be fastened in a variety of ways: a handy way is to have the paper cut a little longer than the circumference of the drum, so as to allow of a little lap, this lap being coated with gum similar to a newspaper wrapper, and a perforated line so as to allow of easy removal. However it may be arranged, there must not be a decided ridge in the circumference, as the drum may require to revolve many times during a series of tests. The paper may be ruled and divided up according to individual requirements.

OPERATION OF APPARATUS

The drum is 10 in. in circumference, and of such a length as to allow the pen to move through a space of 10 in. Taking the drum as moving round once in ten minutes, 1 in. will equal 1 minute, 1-12 in. will equal five seconds. The movement of the pencil will be as follows: 2 rev. of vanes equal 1 ft. of air; 10 rev. of vanes equal 1 contact, owing to the wheel carrying contact pin having ten times the amount of teeth of wheel on shaft carrying the vanes. One contact moves the shaft connected with carriage carrying the pencil round 1-40 of a revolution, owing to the wheel on shaft having 40 teeth in its circumference. Forty contacts therefore move the shaft one revolution.

The shaft having 20 threads to the inch, it will require 800 contacts to move the pencil 1 in., which is equal to 8,000 revolutions of vanes. If, therefore, 2 rev. equal 1 ft. of air, 8,000 revolutions will equal 4,000 ft.

of air, which will equal 1 in. on the paper.

If, for example, the inches are divided into 10 parts, each part will equal 400 ft. of air. In preparing a diagram, the number of feet should be marked both ways from the center. The idea to start at the center was that the vanes were liable to go both ways. If you are certain the air is traveling in one direction only, it would be as well to start at the end as it will enable you to get more diagrams on the same paper.

DIAGRAM TAKEN FROM DRUM

A is a diagram off the drum, a pen being used instead of a pencil.

The diagram shows the air has been traveling mostly in one direction only, and also at a fairly steady rate of about 1,000 ft. in 10 min.

If the velocity of the air is slow it will be obvious that you can get a much longer test or series of tests on the same paper, owing to the pencil not moving along the drum as fast in proportion to the time as if the velocity were high.

A TYPICAL TEST

Now let us assume we are going to carry out the tests mentioned at the beginning of the paper.

We have the transmitter, recorder, and batteries in a suitable box coupled up ready for use. After opening the shaft, we put the transmitter inside, close the shaft, leaving a small hole for the fine, flexible wire with which the recorder would be coupled to the transmitter. We now start the clock, if not already going, and pull the drum round a little from the beginning of the paper, so that the clock can catch up to the drum so as to get rid of any back-lash in the teeth.

When the drum is going steady wait till the start of paper comes under the pen, then drop pen down, at the same time close the switch setting in action the magnets.

We know now that the air is being registered on the paper, so that we can take a walk round, stop the inlet fan a little, open the doors, shut the windows, or do anything else we like, the only thing we have to note is the time and duration of these actions, knowing that any variation these have made in the amount of air passing will be faithfully registered on the paper, and knowing the time we started the recorder we can trace the time and variations when we get home, and if there are any surprising results we shall be spared the worry of wondering if we have taken the reading correctly, besides having saved ourselves much running about.

First Principles of Drying

A substance becomes dry by the evaporation of its inherent moisture into the surrounding space. If this space be confined it soon becomes saturated and the process stops. Therefore, constant change is necessary in order that the moisture given off may be continually carried away.

In practice, air movement is absolutely essential to the process of drying. Hence the necessity of forced circulation by means of a fan, when positive and equable results are desired. Heat is merely a useful accessory to decrease the time of drying by increasing both the rate of evaporation and the absorbing power of the surrounding space.

It makes no difference whether this space is a vacuum or filled with air; under either condition it will take up a stated weight of vapor. From this it appears that the vapor molecules find sufficient space between the molecules of air. But the converse is not true, for somewhat less air will be contained in a given space saturated with vapor than in one devoid of moisture.

The amount of vapor which a given space will contain increases rapidly with the temperature. It is principally for this reason that heat is such a valuable accessory to the drying process. Upon these principles has been developed the blower type of kiln in which all the heating surface is massed in connection with the fan which forces the warm air into contact with the material to be dried.

The Mechanical Ventilation and Warming of St. George's Hall, Liverpool*

By Charles R. Honiball

There exists to-day no finer example of the genius and skill of that brilliant pioneer of mechanical ventilation, Dr. David Boswell Reid, than the warming and ventilation installation of St. George's Hall, Liverpool. Though Dr. Reid was associated with the designs of, or alterations to, installations for many large public buildings in this country, St. George's Hall is the largest public building in which his system of ventilation was carried out in its entirety according to his own views.

The installation has been in constant work since the opening of the assize courts and St. George's Hall in 1851 and 1854, respectively, and it is working to-day. It has proved entirely successful in working, without occasioning any difficulty at any time. Though it may lack modern labor-saving devices, it possesses many, if not all, the essential features which characterize successful installations of to-day, which is the more remarkable when we consider the position mechanical ventilation occupied during the period of the design and erection of the plant (1841-51).

In designing this installation Dr. Reid was guided by the results obtained from a series of experiments he had made, and which clearly demonstrated the necessity not only for a more ample supply of air than had been previously given in public buildings, but also of the introduction of much more specific means for regulating its ingress, and controlling its temperature, state of moisture, and discharge, according to the ever-varying circumstances under which they are occupied.

Peculiar Requirements in Ventilation

The peculiarity of the case, so far as regards St. George's Hall and other buildings of the same class, consists in this: Effective ventilation necessarily demands many special adaptations in such buildings. The great hall, the law courts, the concert room, and the numerous other apartments, connected together by passages in constant communication, made this great work rather resemble a series of public buildings, aggregated together, than any ordinary structure. Special arrangements accordingly became still more indispensable.

When an architect exercises absolute control over everything done in any building, he becomes necessarily responsible for the ventilation, if he uses that control at variance with the views of the ventilating engineer; on the other hand, the engineer might interfere with the architecture were he allowed unlimited power in carrying out his views. A compromise accordingly becomes indispensable where there must be divided responsibility, hence the co-operation of architect and engineer before the erection of such buildings becomes of paramount importance.

The success of St. George's Hall, both from an architectural and engineering point of view, is in a large measure due to the early co-operation of the architect, Harvey Lonsdale Elmes, and Dr. Reid, which enabled them to satisfactorily adjust the rival claims of architecture and ventilation, and evolve an efficient and harmonious arrangement for the whole building before it was erected.

Main Features of Installation

The essential features of this installation may be classed under the following heads:—(1) Supply of air; (2) warming; (3) cooling; (4) moistening; (5) ventilation. The arrangements for these several purposes are shown in the diagrams.

*Paper read before the British Institution of Heating and Ventilating Engineers, London, England, October 8, 1907.

DESCRIPTION OF BUILDING

The building is 490 ft. long and 165 wide, and covers an area, including the approaches, of 3½ acres. The great hall is 169 ft. long from north to south, including the recesses at each end; the width, 74 ft., exclusive of the galleries, which are constructed over the east and west corridors, and 13 ft. in depth, making a total width at this level 100 ft., the arched ceiling being 84 ft. from the ground. The arched ceiling is formed of hollow bricks, each 12 by 4 in. square, there being a hole 2 in. in diameter from end to end. The employment of hollow bricks reduced the weight of the ceiling from 1,000 tons to 600 tons, a saving of 400 tons.

It is interesting to note that Dr. Reid asked for the provision of 400 sq. ft. of area (as equally diffused through the arch as possible) for the discharge of the vitiated air through the ceiling of the great hall. To do this, it was proposed to leave out alternate headers in the solid brick ceiling originally contemplated to be erected, but, with the employment of hollow bricks—which are set vertically upward—the diffusive area for the escape of air was readily obtainable.

The crown court, which is rectangular on plan, is 50 ft. by 47 ft., with a recess or niche, with semi-circular head of 32 ft. 6 in. by 6 ft., in which the bench sit. The civil court is also rectangular on plan, 50 ft. by 46 ft. 6 in., with a niche for the bench 32 ft. 6 in. by 5 ft. 6 in. The concert room is 88 ft. by 72 ft.

Fig. 1 is a longitudinal section from end to end through the center of the building. Figs. 2 and 3 are plans showing the arrangement of the air passages in the basement of the building, at the levels of the upper and lower air channels respectively.

Fig. 4 is a transverse section through the civil court, looking south. In all these diagrams the course of the air is indicated by the arrows, and the vitiated air is shown by the dotted portion.

Fig. 5 is a section of the southwest shaft, showing particularly the course of the open fire-flues to the horizontal flue in the roof, and gallery in the south part of the great hall.

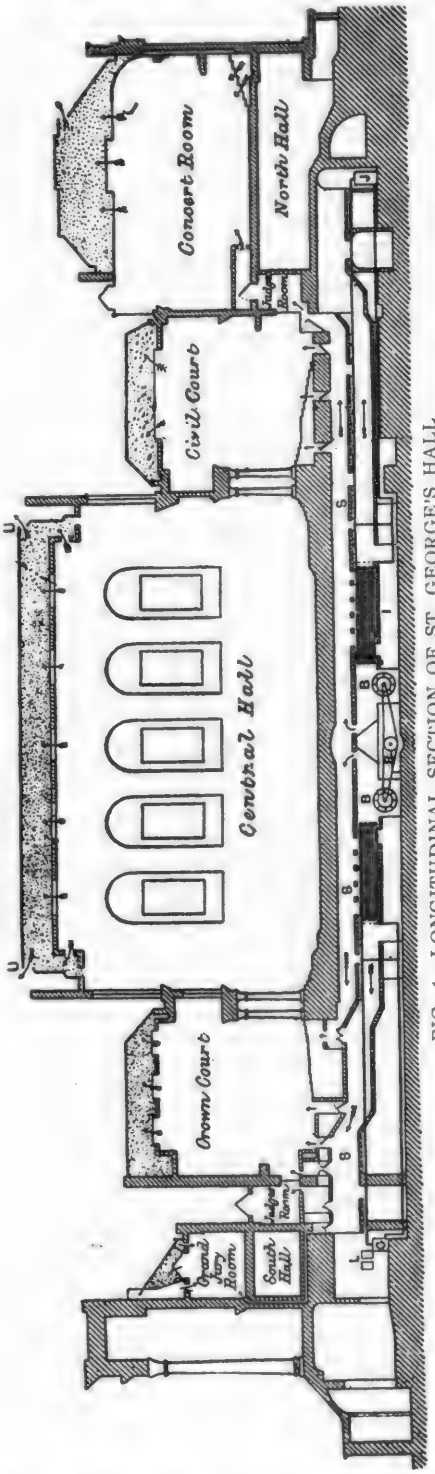


FIG. 1—LONGITUDINAL SECTION OF ST. GEORGE'S HALL

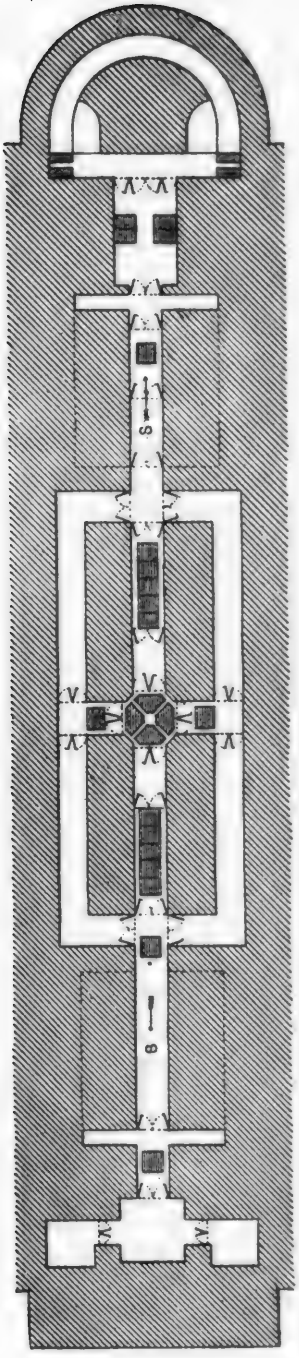


FIG. 2—BASEMENT PLAN, ST. GEORGE'S HALL, AT LEVEL OF UPPER AIR-CHANNELS

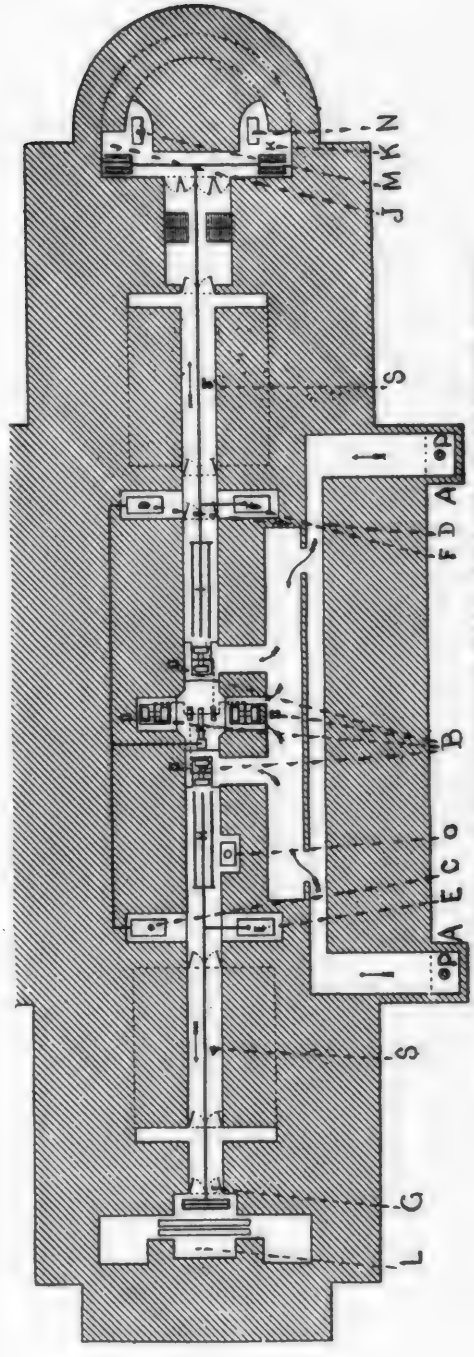


FIG. 3 BASEMENT PLAN, ST. GEORGE'S HALL, AT LEVEL OF LOWER DUCTS

SUPPLY OF AIR

The principal supply of air is by the two shafts, *A A* (Figs. 3 and 4), at each end of the east portico. These are connected together by a long passage, from which there are lateral arches leading to the four ventilating fans, *B*, that propel the air through the building. There are also supply shafts to each court, and openings along the sides of the great hall, immediately above the windows (Fig. 1), by which air is brought down to the galleries of the hall, so that when necessary a very large additional supply of air can be obtained from the highest part of the building; but in general the supply from the shafts *A A* alone is preferred, and with few exceptions has been found sufficient. In addition to the above, the windows in the individual apartments are made to open to the external atmosphere, except in the witness room on the east side of the principal floor, and in the judge's room at the civil court.

WARMING

The arrangements for warming may be divided into four sections: viz., the water apparatus, the steam coils, the special steam apparatus, and the open fireplaces.

I. THE WATER APPARATUS

This constitutes the more important source of heat for the great hall, the crown and civil courts, and the concert room, and that which is preferred at all time, when its power is sufficient without the use of the steam coils. There are five hot water coils, Fig. 3, at *G H I J K*, and on account of their situation are named as follows: The great south hall water apparatus, *G;* the great south water apparatus, *H;* the great north water apparatus, *I;* the west concert water apparatus, *J;* the east concert water apparatus, *K*. The action of these coils can be directed in a variety of ways, according to the special occupations of the different portions of the building. The whole of the heat can be directed on any of the great apartments, or subdivided as occasion requires, by opening or closing the numerous valves and doors in the air chambers that extend all over the building.

There are two hot water boilers, *E F*, Fig. 3, of the Cornish type, each 5 ft. diameter by 15 ft. long, the furnace tube being 3 ft. 3 in. diameter. Each boiler is provided with a large cylindrical dome, which is placed a few feet from the front of the boiler. From this dome the flow pipe, 12 in. diameter, rises to the expansion tank on the floor above, the water level of which is approximately 4 ft. above the center of the flow pipe. The hot water flows to junction boxes placed in the air chamber, and from thence distributed through large valves and pipes to the manifolds of the heating coils.

The flow and return pipes and stop valves, on both flow and returns to and from the boilers, are 12 in. diameter. The flow and return pipes and the manifolds for the great north and south water coils are each 10 in. diameter. The flow and return pipes and manifolds for the coils at the north and south ends of the building are 8 in. diameter. The coil ends are connected by flanged expansion joints to each manifold, and the connecting pipes between boilers, valve boxes, and flow and return mains are amply provided with expansion joints. The mains are all flanged, and jointed with sheet lead. The hot-water coil pipes are 4 in. diameter and made of cast iron.

The whole of the cast-iron mains, hot-water coils, and hot-water boilers are still in operation; the only repairs carried out have been in connection with the boilers, several plates for the shell and furnaces have been renewed during the past few years. The boilers are otherwise sound, and have been passed as such by the boiler insurance company in September this year.

The hot-water mains in boiler house, and air channels, and also the main stop valves, are lagged with hair-felt and canvas, which was afterward painted and varnished. This lagging is in a splendid state

of preservation, and remains a credit to those who executed the work sixty years ago.

Thermometers are fixed in front of each boiler, as well as on the main coils and returns, so that the difference of temperature of the flow and return pipes can be easily ascertained. Originally, each boiler was also fitted with an electric thermometer, which operated an electric bell in the office of the superintendent, when the temperature of the water in the boilers exceeded a prearranged limit.

These thermometers consisted of an iron bottle about 12 in. long, fitted with two glass tubes containing the terminal rods of the circuit. The bottles were partially filled with mercury, which, when expanded by heat, rose in the glass tubes and so completed the circuit by coming in contact with the terminal rods. The temperature at which the bell will operate can be adjusted by raising or lowering the rods accordingly. These thermometers have not been in use for very many years.

THE STEAM APPARATUS

The steam apparatus, as originally fitted, consisted of 27 coils, of which three are shown at *L*, *M*, *N*, Fig. 3. They are used principally for heating the chambers, halls, corridors, in which they are placed previous to the commencement of business. They are then shut off when the hot water is found sufficient or sustained, more or less, according to the state of the external atmosphere, the amount of air required, and the manner in which the hot-water apparatus may at any moment be appropriated. All the steam coils are provided with valves or stop cocks, and can be put into operation either collectively or individually. The main coils were constructed of 2-in. wrought-iron tubes, as also were those for warming the cell corridors. The heating coils fitted in the gallery air-shafts are of 1-in. wrought-iron tubes.

During the past five years many of these coils have been renewed. The coils *L*, *M*, *N* have been replaced by indirect gilled radiators, and many of those in the basement corridor renewed, but many still remain. The steam coils for the gallery air-shafts have not been in action for very many years, and all trace of their connections to the boilers obliterated. There are two steam boilers, each 5 ft. in diameter by 15 ft. long, the furnace being 3 ft. 3 in. in diameter. The boilers now in use are not the originals; the latter were removed about twenty years ago.

One of the present boilers was—owing to structural difficulties in the way of getting in position—riveted together in the boiler house. The main steam pipes are those originally fitted; they are of cast iron, flanged, and 4 in. bore. The arrangement is such that both boilers can be placed in communication with each other, the necessary stop valves being fitted to admit of this.

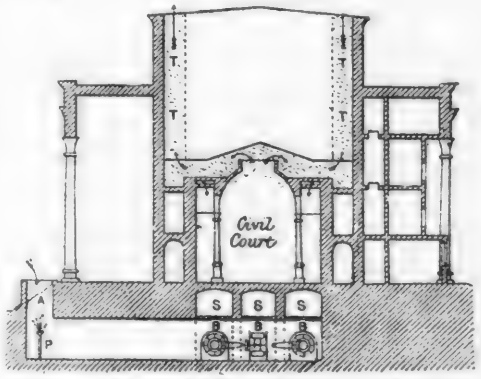


FIG. 4—TRANSVERSE SECTION THROUGH CIVIL COURT

The boilers supply, in addition to the steam coils, steam for working the organ engine, fan engine, and engine for pumping water for the fountain. The steam pressure carried on each boiler very rarely exceeds 40 lbs. per square inch, the fuel employed being ordinary coke. The smoke flues for the boiler furnace are taken into the main vertical flues in the angles of the great hall, as shown on Figs. 4 and 5.

In addition to supplying heat by steam coils, Dr. Reid also made arrangements for the direct infusion of steam into the warm air. For

this purpose steam was generated in a small copper boiler, *O* (Fig. 3), and conveyed through heavy block-tin pipes through the air channels to the heating coils. His instructions for the use of this arrangement were as follows: "When the building is very cold and any part of it is required very suddenly, and when the external atmosphere is very cold and dry, the action of the steam apparatus may be greatly assisted by the copious infusion of steam, till the hygrometric condition of the air is satisfactory. But care must be taken when this is done to prevent such a quantity of steam being communicated to the air as may be apt to be followed by any disposition on the walls. So long as the steam rapidly disappears, or becomes dissolved in the air in contact with it, it may, in general, be added with advantage; but when the hygrometer indicates an excess of moisture and the vapor remains as a cloud, the supply must be checked."

The whole of this plant is still in existence, but it has not been in action for very many years.

OPEN FIREPLACES

In all the minor apartments open fireplaces have been fitted. They were not primarily intended for the ordinary purpose of heating the apartment in which they are placed, but for enabling those who have been chilled out of doors to experience at once the effect of a powerful warmth, which is so grateful to many, and so often demanded. The chimneys are all collected into four great smoke shafts, forming portions of the angle shafts in the great hall, as shown on Figs. 4 and 5.

COOLING

For several years after the erection of the installation, the hot-water coils were employed during the summer for cooling the air. Cold water from the town main was caused to run through them to such an extent as was deemed necessary. The temperature of the town main water in the hot weather was generally from 54° to 56° F., while the external air was at 60° F. and upwards. This method of cooling was carried on as late as 1864.

MOISTENING ARRANGEMENT

When cold air, which usually contains little moisture—unless it be mechanically suspended in it—is warmed artificially, it acquires an additional power of absorbing moisture. If warmed by natural means in the open atmosphere, it commonly obtains additional moisture from the surface of the ocean, or of the ground over which it passes; and, accordingly, very warm air without a corresponding amount of moisture, is, in this country at least, comparatively rare. In order, therefore, to render air similar to air warmed by natural means, in this respect at least, moisture must be communicated to it artificially.

This is usually effected by the evaporation of water in the air that is heated; or by the direct action of a steam pipe or coil passing through the water to be evaporated; or by the direct infusion of steam from a boiler; or from a fountain-producing artificial spray. The direct infusion of steam from a boiler expressly devoted to this purpose is, on the whole, the most manageable, and tends to warm the air at the same time, instead of cooling it, as the evaporation of water always does. The purest water should alone be used for this purpose, and the boiler maintained scrupulously clean.

The infusion of steam when required for local effect is made immediately after the air passes any principal warming apparatus; but a similar purpose may be insured by an excess of moisture thrown, in the shape of visible vapor, into the air channel before it reaches the warming apparatus. In Dr. Reid's installation, infusion of steam was employed. Steam was generated in a small copper boiler, *O* (Fig. 3), and distributed through heavy block-tin pipes 2-in. bore. The nozzles for discharging the steam are placed in such position as to command both the cold and warm air on its way to

or from the fans. These nozzles are also fixed so as to command the steam and hot-water coils at each end of the building.

A few years later the fountains, *P*, in the entrance air-shafts, *AA* (Figs. 3 and 4), were erected. These consisted of a perpendicular pipe, having at the top a semi-circle of radiating jets, small and finely perforated, through which water from the town main flowed. Thus, before the air is allowed to enter the cold-air chambers, it must pass through a spray of water varying from a gentle shower to a saturating mist, not so much for the purpose of receiving moisture, but in order that it may be washed and purified, cleared of smuts, dust, and dirt. These fountains are not now in existence, and the infusion of steam has been discontinued, though the whole of the apparatus still remains in position.

VENTILATION

The ventilating arrangements were designed to supply from 7 to 10 cu.ft. of air per minute to each person occupying the building; the extent of opening of the supply valves is, therefore, regulated by the number of persons present, the quantity of air driven through the building varying from 1,000 to 50,000 cu. ft. per minute. The openings for the diffusion of the air into the several compartments of the building are as numerous as its structural arrangements will allow, and they are controlled in such a way that the whole or only a portion of them can be open at one time.

Exactly under the middle of the floor of the great hall, a 16-horse-power steam engine is fixed at *R* (Figs. 1 and 3), for the purpose of driving the four fans, *BB*, which are 10 ft. diameter and 5 ft. broad, the blades being 2½ ft. in width; they are driven at a speed of from 45 to 60 revolutions a minute. The engine is of the horizontal, reversible type, and drives the four fans through wheel gearing, pulleys and belting. The fans are placed one on each side, and are known from their position as the north, south, east, and west fans. The engine room is constructed of wrought-iron plates, 3/16ths in. thick, riveted together, and has a tapering top, which acts as deflectors for the air from the fans.

The space between the floor of the hall and the engine room is divided into three channels, *S* (Fig. 4), called respectively the cold, warm, and temperate air channels. Each fan has its own section, and the four fans may thus be working simultaneously on different parts of the building, distributing air at different temperatures, according to the occupation of the different apartments. When necessary, however, all the four fans can be easily concentrated and made to supply air to any one section of the building. Thus the air may be driven through the main north coil *I*, and after being warmed thereby, may be conveyed to the civil court and the concert room (Fig. 1); while the main south hot-water apparatus, *H*, may be shut off, so that cold air is supplied to the great hall and the crown court. These arrangements can be readily interchanged in any manner desirable by simply altering the arrangement of the valves in the air passages. When simply warming up the building, all the valves for the escape of vitiated air are closed, and the same air is circulated round the hall, courts, and corridors, until the required temperature has been reached. By thus preventing the escape of warm air before it is contaminated, a considerable saving is effected in the consumption of fuel. The building is kept at a temperature as near 65° as possible.

The vitiated air is discharged at the ceilings of all the apartments, as shown by the dotted portions in the diagrams (Figs. 1 and 4), and after passing through the channels between the ceilings and roofs, is discharged into the external atmosphere by the four shafts, *T* (Fig. 4) forming the angles of the great hall. Every panel in the ceilings is controlled by a valve, and the number that may at any time be opened de-

pends upon the quantity of fresh air supplied from below; the supply is made to regulate the discharge.

With the exception of the great hall, the whole of the vitiated air from the concert room, courts, rooms, and cells is drawn toward the four shafts, *T;* and in order that this may be done as effectually as possible, provision is made for large jets of gas to be used, as occasion may require, for rarefying the air in these shafts and thereby drawing off the vitiated air more rapidly. The draught of the shaft is controlled by iron doors, and can be regulated to suit the various movements to which the ventilation of the building is adopted.

Owing to the height of the great hall, the four shafts, *T*, are not available for this portion of the building, and the vitiated air from it is therefore discharged through the ceiling of the hall into a large vitiated-air chamber formed between the ceiling and the roof, and afterward into the open air through the glass louvers (Fig. 1), which extend all around the highest part of the roof. These louvers are controlled by valves, so that any side may be used for the discharge of the vitiated air, according to the direction of the wind.

The various chimneys of the building are collected in the four shafts, *T* (Fig. 4), but before reaching them the smoke from the fireplaces is collected into horizontal flues of large area, passing beneath the roofs, lower than the highest portions of the building, and afterward ascending the vertical shafts. These four great shafts are each divided into three compartments (Fig. 5), two being for the smoke, and one for the vitiated air, each of the four boilers having a special flue to itself.

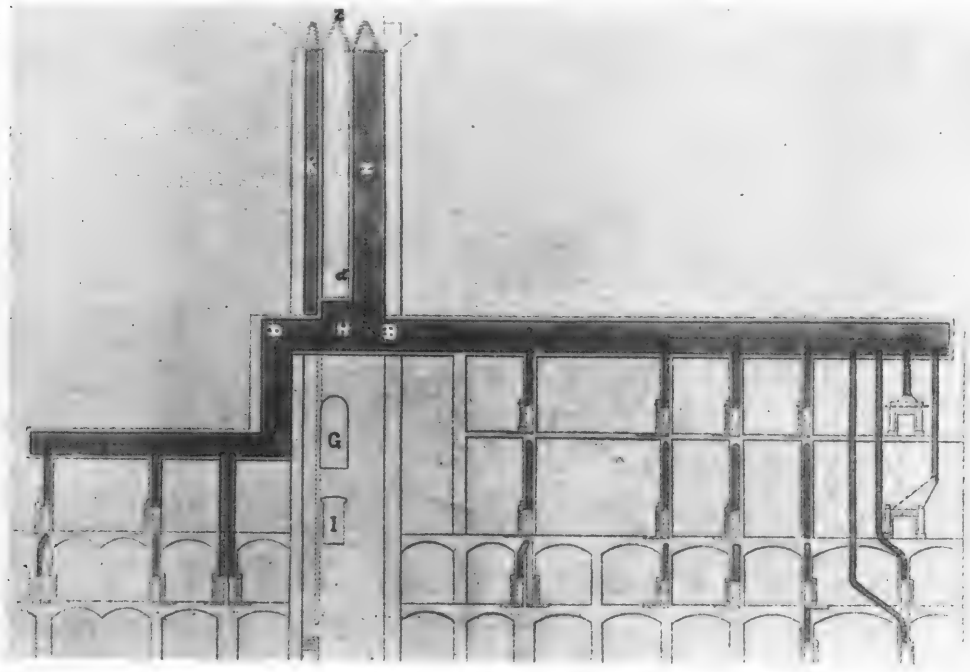


FIG. 5—SECTION OF SOUTHWEST SHAFT, SHOWING COURSE OF OPEN FIRE FLUES

On the top of these shafts, but not reaching above the height of the parapet wall, iron louvers are fixed, made of angle iron and thin sheet iron, and constructed so as to allow the vitiated air and smoke to escape as well as to prevent the rain from descending. Surrounding these louvers, deflectors are placed for the purpose of breaking the force of the wind, thereby causing an eddy, and thus preventing a down draught.

Dr. Reid considered that in intro-

ducing these shafts he had effected a great saving in the architectural expense, besides maintaining more strictly the style of architecture adopted. These four shafts have prevented the introduction of ornamental chimneys, and have saved the building from the unsightly incongruities too frequently seen on chimney tops of public buildings for the purpose of preventing a down draught.

The air valves in the warm-air chambers are light wood frames, covered with canvas and strong paper, and afterward painted and varnished so as to allow of washing, and are to-day in a splendid state of preservation. They are hinged along one side, and are operated by light pulley blocks and ropes. The walls of the warm-air chambers are covered with a composition of cinders and plaster from 2 to 3 in. in thickness, so as to enable them to retain the heat when once they are warmed. The walls of the vaults and fresh-air channels are kept thoroughly whitewashed, and the floor clean and free from all objectionable matter.

Viewed scientifically, the building is an immense pneumatic machine, kept in operation according to the necessities of its occupation. When the building is unoccupied, the air courses through the warm and cold-air chambers, hall, courts, and corridors, to the extremities of the building, whence it returns to its central course to be again dispersed. But with the building in occupation, the order is different; the air then becomes contaminated and is discharged, and the supply and discharge are proportioned to the extent of contamination.

It is easy to admit air or remove it from any part of the building, or to reduce its action; but the amount of satisfaction finally depends on the skill and delicacy with which the movement, temperature, moisture, and quantity of air are adjusted, so as to suit the feelings of the audience during the various seasons of the year.

Charts Showing the Performance of Hot Blast Coils

By Burt S. Harrison

In view of the fact that there has never been published, to the writer's knowledge, up to the present time, any tables, curves or other data whereby the performance of hot blast heater coils under different conditions could be determined, the accompanying charts are submitted which may be of interest. These charts, which have been used with success by the writer in figuring hot blast work, take account of all the varying conditions for coils having approximately 35 per cent. of free area for the passage of air through them, provided only that the coils are all prime heating surface. Of course, if the coils are air or water bound, the results given by the charts will not be attained.

The only other charts or tables of this nature which have come to the writer's knowledge have been based either on one particular velocity for the air passing through; on one particular steam temperature; or on a particular temperature for the entering air, and, consequently, one or two correcting co-efficients have had to be applied, if these conditions were varied. On the accompanying charts the results may be read directly and no corrections are necessary.

How to use the charts

Suppose a case in which the fan size and delivery have been decided, then the desired velocity of the air through the heater coils is easily fixed with reference to its velocity through the inlet ring of the fan. The free area of the coils being 35 per cent. (approximately), the size of the coils is easily determined from

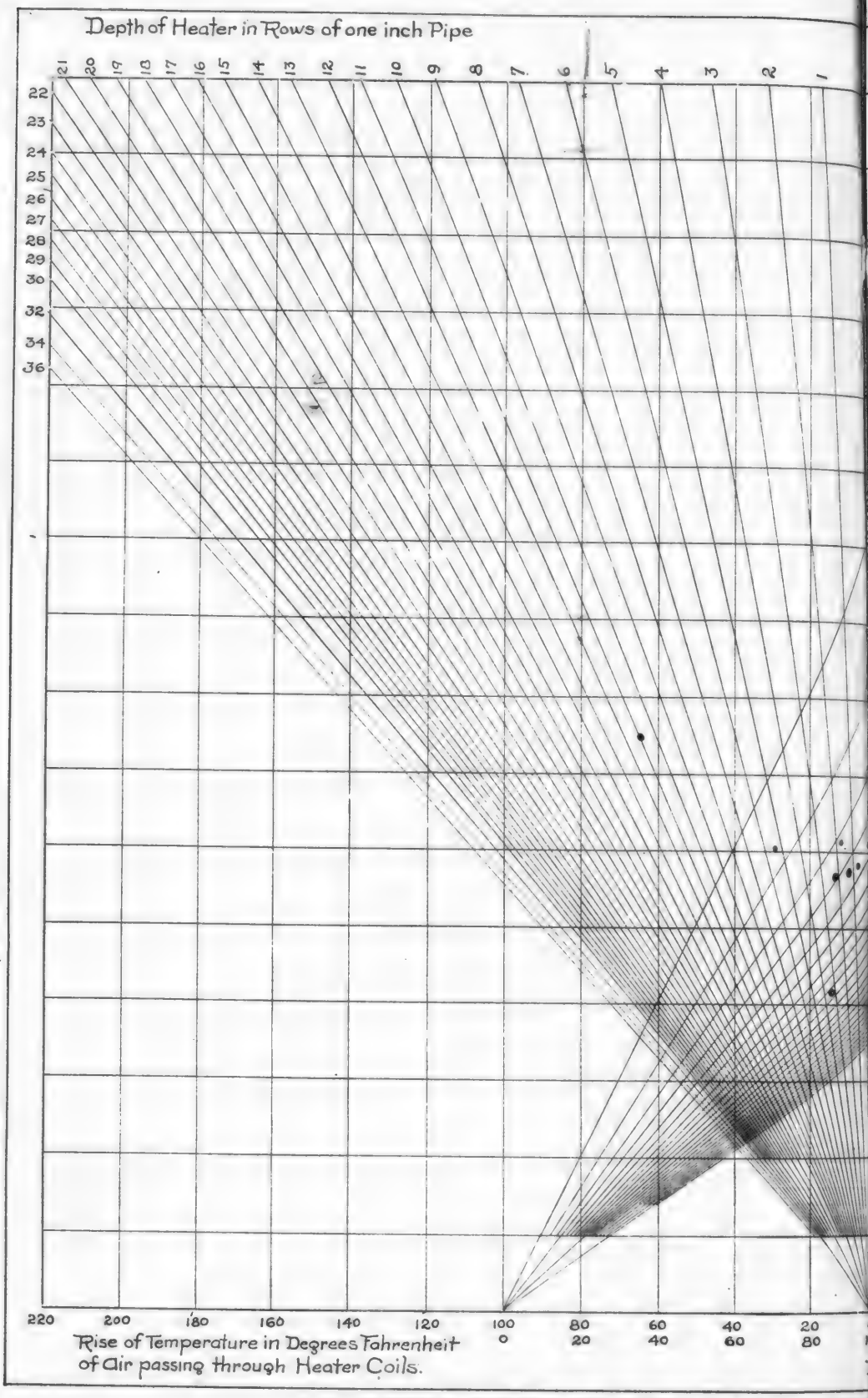
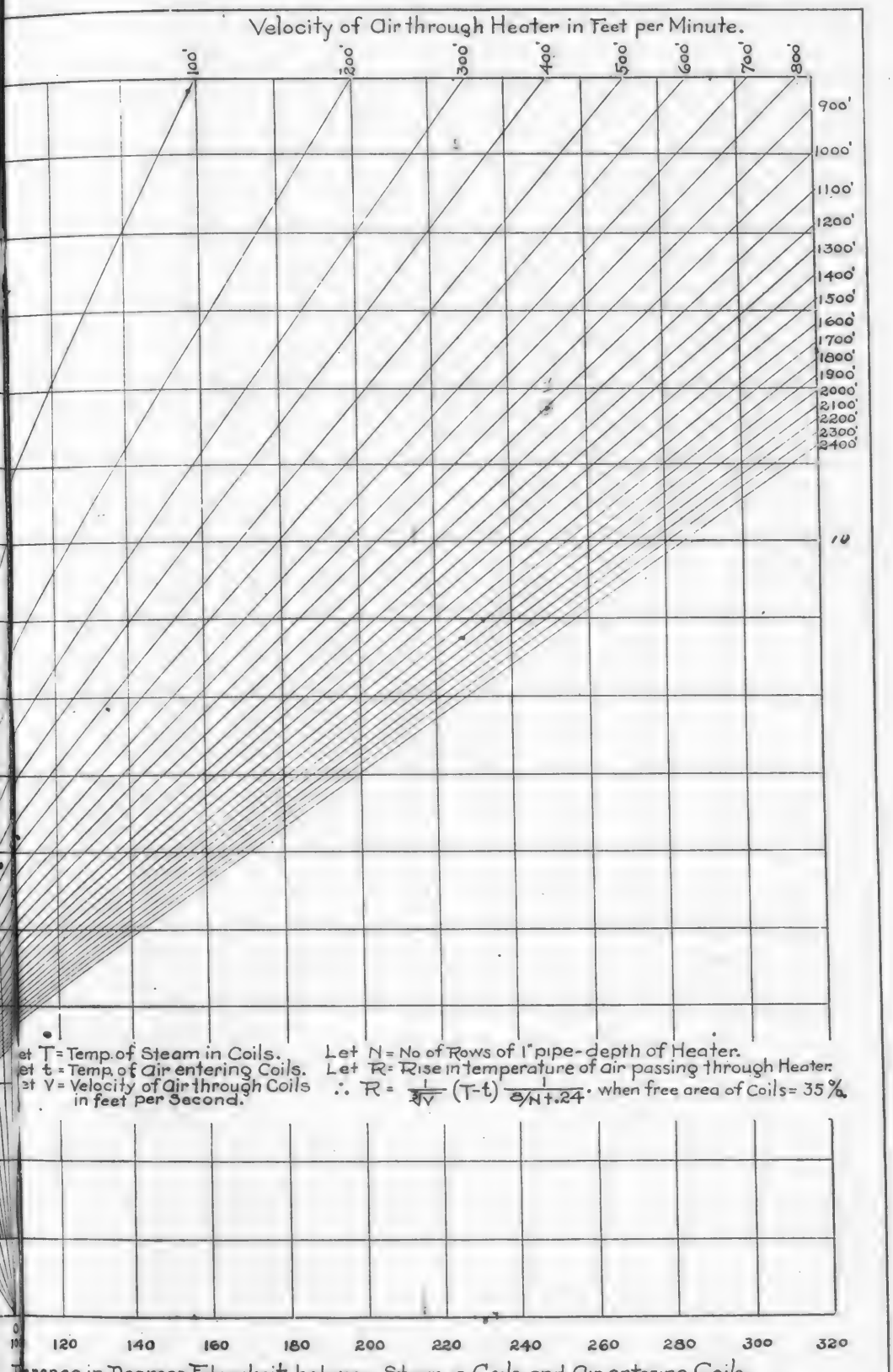

Depth of Heater in Rows of one inch Pipe
21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
22 23 24 25 26 27 28 29 30 32 34 36
220 200 180 160 140 120 100 80 60 40 20 0
0 20 40 60 80
Rise of Temperature in Degrees Fahrenheit of Air passing through Heater Coils.

CHART I.—SHOWING RISE IN TEMPERATURE OF AIR P



PING THROUGH HOT BLAST HEATERS, WITH FORMULA

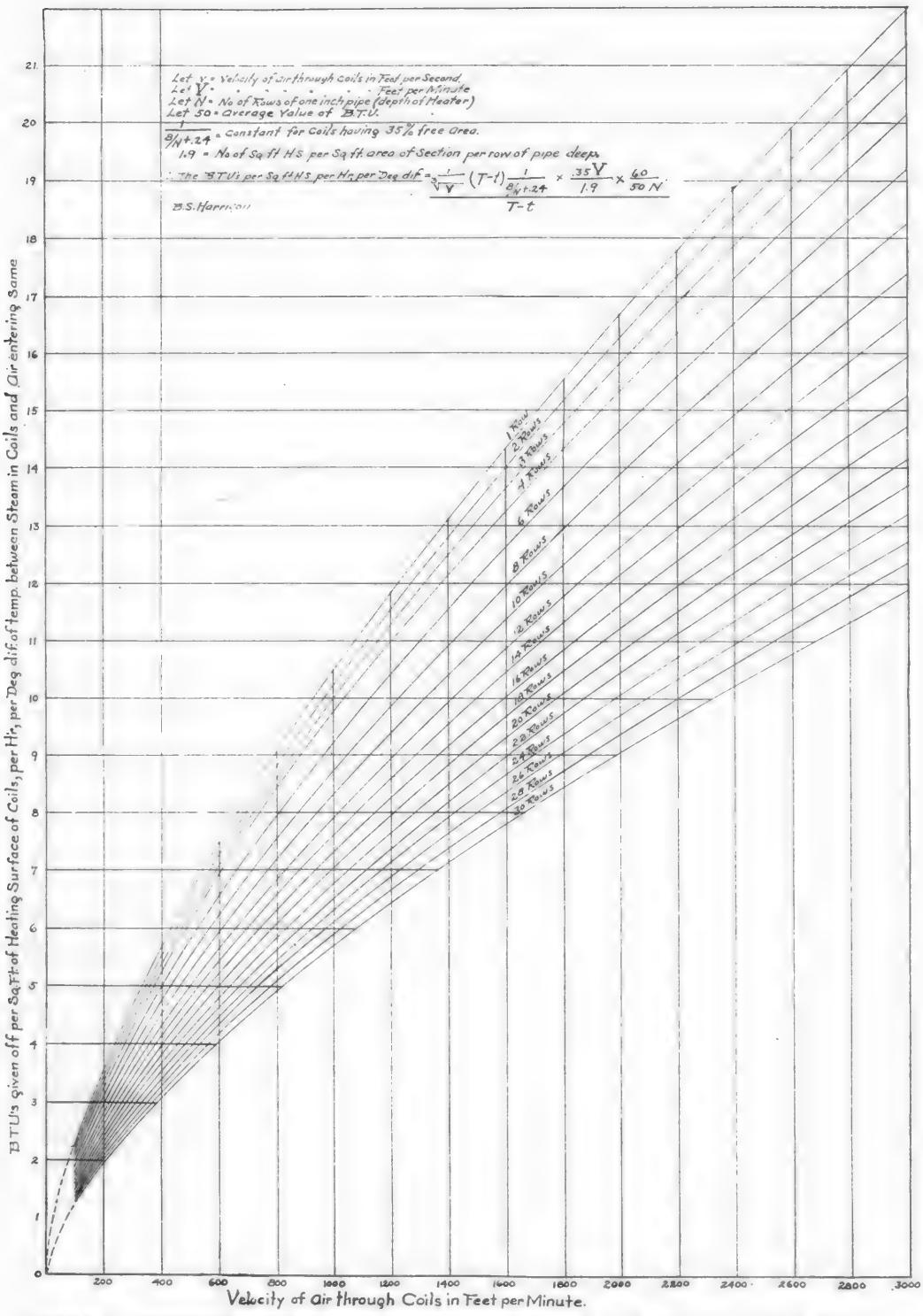

Let v = Velocity of air through Coils in Feet per Second.
Let V = " " " " " Feet per Minute
Let N = No of Rows of one inch pipe (depth of Heater)
Let 50 = Average Value of B.T.U.
1/(B/N+24) = Constant for Coils having 35% free Area.
1.9 = No of Sq ft H.S. per Sq ft. area of Section per row of pipe deep.
∴ The B.T.U's per Sq ft H.S. per Hr. per Deg dif = 2 1/√V (T-t) 1/(B/N+24) × 35V/1.9 × 60/50N / T-t
B.S. Harrison
B.T.U's given off per Sq ft of Heating Surface of Coils, per Hr, per Deg dif of Temp. between Steam in Coils and Air entering Same
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
1 Row
2 Rows
3 Rows
4 Rows
6 Rows
8 Rows
10 Rows
12 Rows
14 Rows
16 Rows
18 Rows
20 Rows
22 Rows
24 Rows
26 Rows
28 Rows
30 Rows
200 400 600 800 1000 1200 1400 1600 1800 2000 2200 2400 2600 2800 3000
Velocity of Air through Coils in Feet per Minute.

CHART II.—SHOWING HEAT UNITS GIVEN OFF BY HOT BLAST HEATERS, WITH FORMULA

the velocity of air through them and the amount of air required per minute.

To determine the amount of heating surface required to raise the air to the desired temperature and the number of rows of 1-in. pipe in depth of heater, proceed as follows:

Suppose the steam pressure to be used gives a temperature of steam of 240° F.

Suppose the temperature of the entering air to be —10° F.

Then the difference in temperature (steam and air) is 250° F.

Suppose the desired velocity through the coils is 1,000 ft. per minute.

Suppose the temperature desired in the heater coils is 140° F.

The rise in temperature of the entering air is, therefore, 150° F.

On Chart I find the point corresponding to the difference in temperature between the steam in the coils and air entering same (250° F.) at the bottom right hand side of the chart. From this point follow vertically with the pencil to the intersecting diagonal line representing 1,000 ft. velocity of air. From this point follow horizontally to the left. Placing a celluloid triangle or scale horizontally on this line to mark the place, find the desired total rise in temperature of the entering air (in this case 150°) on the scale at the bottom, left hand side of chart. From this point follow upward vertically to the point of intersection with the horizontal line marked by the triangle. The nearest diagonal from the upper left hand corner of the chart to the above point of intersection will represent the number of rows of 1-in. pipe required in the depth of heater to give the required results, in this case 19 rows, or, say, 20 rows in order to use standard two or four-row heater sections.

If desired, the same thing may be figured out by means of the formula given at the bottom of the chart, but the chart is more easily used and does not give so much chance for personal error.

In a similar way, Chart II shows the number of B. T. U. of heat given off per square foot of heater coil surface per hour, per degree difference of temperature between the steam in the coils and the air entering same, on the basis of coils of 35 per cent. free area and having 1.9 sq. ft. of heating surface per superficial square foot of coil area per row of pipe in depth. The formula for this chart is also given at the lower right hand of the sheet.

The advantage of a graphical solution of these formulæ is obvious, for with little figuring it can be ascertained exactly what each section or each row of coils in a section of a blast heater is doing.

Applications of the Fan Blower

The advent of electrical means of driving simplified in many ways the application of the fan blower. An electrically-driven fan may now be placed at the most convenient point without extended systems of piping and with minimum loss through friction in pipes. Marine installations have called for special designs, in many of which a fan is arranged to be suspended from the deck above and driven by direct connected motor attached to the side plate. On shipboard portable electric blowers fitted with flexible pipe connections are employed for temporary ventilation of close spaces in the hold.

In modern installations the production and distribution of illuminating gas calls for gas blowers and exhausters which blow the generators and transport the gas through long distances or from holder to holder. With this arrangement the works may be located at the most convenient point outside the city limits and the gas forced through relatively small pipes under considerable pressure to all parts of the city. Local boosting of pressure may be very simply provided by small blowers. This method of increasing the pressure is almost invaluable in localities where the consumption has outgrown the capacity of the pipes.

THE HEATING AND VENTILATING MAGAZINE

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IN THE publication of the hot blast heating charts elsewhere in this issue, the author, Mr. B. S. Harrison, has made a valuable and useful contribution, which no doubt will be widely appreciated, to the available information on this branch of the heating art. It will be of interest to state that the charts are the result of many years' observation of the performance of hot blast coils. The discovery of a formula that will apply under all the conditions of varying velocities and temperatures of air and varying steam temperatures is an achievement the importance of which will be instantly recognized by all who are called upon to design hot blast heating installations.

As Mr. Harrison states, other charts and tables of this nature are based on a given velocity for the air passing through the coils or on a given temperature of the steam, thus involving the use of coefficients in case of varying conditions. In the accompanying charts the results under any conditions may be read directly, and this feature is what, we believe, will give the charts and formula a permanent place in heating literature.

A SIGN of the times, not as yet fully appreciated in the East, is to be noted in the comments of a mid-western paper on the rapid growth in that section of the idea of central station steam or hot water heating plants for the heating of both business and residential districts of towns and cities.

"A modern convenience of much value," says the writer, "may be expected to come into general use with the establishing of central plants to furnish heat by pipe lines for buildings in the large cities. A plant of this kind has been operating in Kansas City for some time, and its practicability is evidenced by the fact that the owners of the new fifteen-story National Bank of Commerce and the eight-story building at Eleventh and Walnut streets have contracted with the company to furnish their entire supply of heat, thus dispensing with all heating apparatus in the buildings themselves. If experience demonstrates the reliability and adequacy of the system, it is likely that within the next few years most, if not all, office buildings and stores will be heated in this manner."

WITH the growing use of exhaust steam for the heating of buildings, coupled with the rapid progress being made in the application of the steam turbine, modern heating practice, especially in the middle West, is undergoing a development involving a noticeable divergence from past methods. If the steam turbine is eventually to usurp the place occupied by the recipro-

cating engine, it will be essential not only to eliminate any degree of back pressure, but to provide effective condensing apparatus, and this might be expected to have a very serious effect on a system of exhaust steam heating. The demand is heard with increasing frequency in the West for steam at atmospheric pressure and central heating stations are engaged in meeting this demand. A vacuum system would seem to be the logical answer to the problem, but here again a difficulty arises in connection with the high vacuum called for by a steam turbine. Numbers of experiments have been tried and several patents are now pending of apparatus designed to furnish exhaust steam from a turbine for heating purposes at atmospheric pressure.

WE are reminded of the agitation a year or more ago over the subject of tunnel ventilation with special reference to the New York Subway by the receipt of a letter from one of our readers in which he asks us to again direct attention to the unsatisfactory results obtained from the present system of ventilation. As is well known, the scheme adopted for ventilating New York's subways makes no provision whatever for the admission, by mechanical means, of outside air. The most that has been done in this direction is to provide outlets in the form of louvers through which the air is partially expelled by the action of passing trains, the partial vacuum thus created being depended upon to draw in fresh air at the station entrances. In addition to this there are at some of the larger stations blowers connected with air coolers through which the same air is rotated throughout the summer, with no special means of freshening the supply. Our correspondent complains that during the recent warm weather especially the tunnel has had a temperature far in excess of that on the street, with all of the ventilating apparatus in full operation.

The present time, when the operation of New York's subways is being made a subject of inquiry on the part of the Public Utilities Commission, would seem to be a favorable one for advocating a system of ventilation for the underground railroads that would be worthy of the name.

A PROPOSAL has been made by a Canadian heating trade paper urging an organization in Canada of heating and ventilating engineers and recommending that such an organization affiliate itself with the American heating engineers' society as a chapter of the latter organization. One of the things that has brought this matter to the minds of Canadians at this time is the fact that the recent summer meeting of the American society was held at a point close to the Canadian border. The other factor was the recent meeting in Montreal of the National Association of Master Plumbers, Steam and Hot Water Fitters of Canada. At the Montreal convention the brilliant prospects for the future of the heating profession in Canada were evident to a marked degree; the growing opportunities for Canadian business have for some time been an important factor in the plans of the more progressive American manufacturers of heating goods. The fact that Canada is at present without a representative organization of essentially heating and ventilating men is not in keeping with the Dominion's requirements or opportunities in this direction.

Dust Removal in a Brass Foundry*

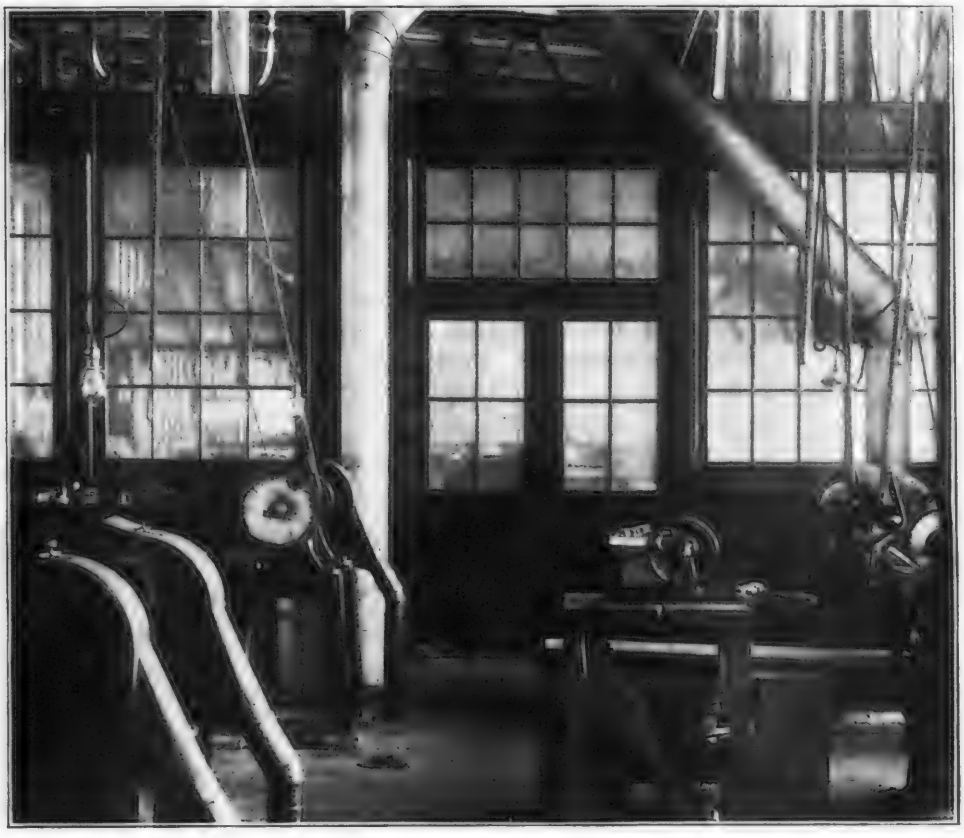
By Walter B. Snow

In much of the early work done for the welfare of the employee there was a strange confusion of motives. Even though the project was primarily humanitarian in its spirit, the advertising department got in its work in proclaiming this spirit to all the world. But out of this confusion has now grown a definite recognition of the purely economic advantages of surrounding the workman with healthful conditions. While some other industries are more directly harmful to the health than is the brass industry, there is, nevertheless, ample opportunity within its field to greatly improve the conditions. Although the heat and the fumes are primarily uncomfortable and only secondarily injurious, the greatest harm is done by the dust which is inhaled. This dust is usually of mineral or metallic origin, resulting from the grinding, polishing, tumbling and sandblasting processes, and also from the shaking out of the castings.

*From a paper read at the recent Convention of the American Brass Founders' Association in Philadelphia.

METAL DUST CAUSES TUBERCULOSIS

It is commonly recognized that life is shortened by working in a dust-laden atmosphere, but the extent to which some industries are injurious is startling. In the cutlery and tool industry, which is declared to be one of the most dangerous trades in this class, the average age of the operatives at death is exceedingly low, and in establishments conducted without proper hygienic precautions sound men are rare after a few years' work. The prevailing cause of death is consumption, which usually overtakes a susceptible worker so early that his period of usefulness does not extend much beyond five or six years



EXHAUSTING ARRANGEMENT WITH PIPES CARRIED BENEATH THE FLOOR

except where the health is properly safeguarded.

The testimony of physicians is that of those employed in this industry nearly all who reach the age of forty die of consumption, excepting those who succumb to some acute disease. As a proof of this statement, it is instructive to note that in Northampton, Mass., an important seat of the cutlery industry, the death rate from tuberculosis for the entire male adult population was 2.9 per thousand, while that for the cutlers of that town was four times as great—namely, 11.8 per thousand.

The trouble lies not so much in any directly poisonous results from inhaling the dust as in its power to bring about constant irritation, which produces such a condition of the mucous surfaces that they more readily admit of invasion by disease germs. Fortunately brass is less irritating than steel, and consequently the results in the brass industry are not so disastrous as they are among the cutlers. But the dust of corundum and emery is peculiarly irritating, and the brass workers' surroundings are therefore susceptible of marked improvement.

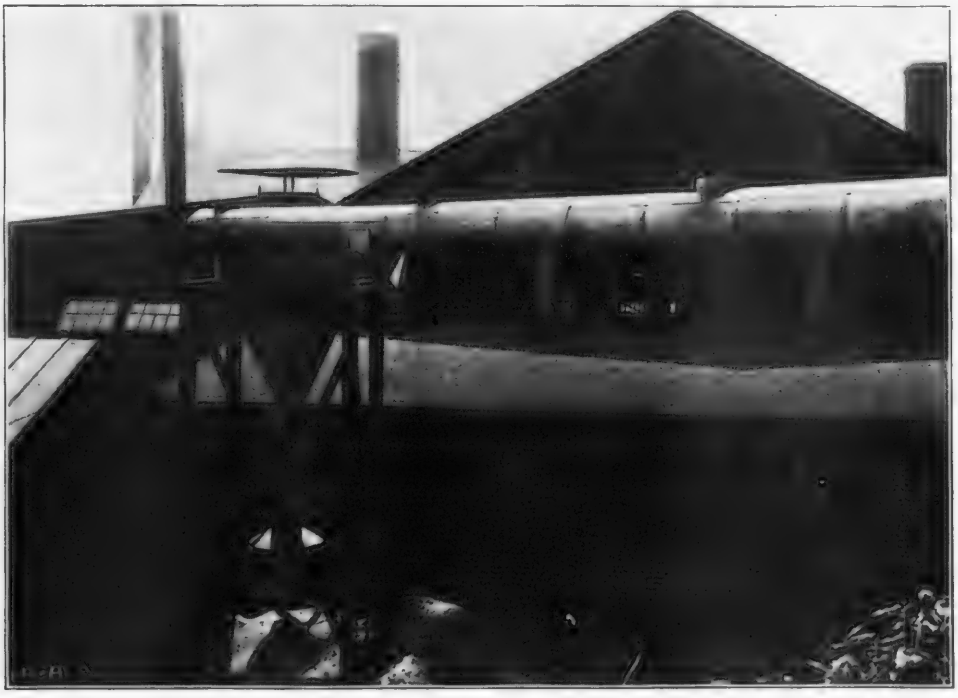
LAWS TO SAFEGUARD HEALTH

The unhygienic conditions existing in the various industries have received the attention of State Boards of Health, whose official investigations are bringing about the passage and enforcement of more stringent laws looking to the safeguarding of the health of the employes in all industrial establishments.

In a word, advance has been made from a matter of individual interest to one of almost national importance. The statue books of the leading states of the Union already contain laws, usually somewhat vague in their ex-

ARRANGEMENT OF HOODS FOR UPWARD EXHAUST

MODEL EXHAUSTING ARRANGEMENT WITH MAIN PIPE ON FLOOR



ARRANGEMENT OF DUST COLLECTOR WITH CLEAN-OUTS IN PIPE AND FREE DUMP FOR DUST

pression, which require cleanliness, light, warmth, ventilation, and the introduction of specific devices for removing dust, fumes, and the like. While the first impulse of the manufacturer may be to resent the enactment of further laws, yet his compliance with them is not without eventual advantage. Not only will a better class of men prefer to work for him if improved conditions are provided, but there will be far less interference with work because of sickness, more energy in the work which is done, and less loss by death of the potential value possessed by the man who has become thoroughly skilled in a given line of work. Continued sickness and death naturally mean constant replacement of individuals, with the loss of knowledge and skill gained by those who have gone. As a result there is far less stability of employment in an unhealthy industry.

MECHANICAL MEANS NECESSARY FOR REMOVAL OF DUST

Experience has shown, and the reports of investigations confirm the fact, that mechanical means are absolutely necessary to maintain a rapid air change or to insure proper removal of dust. In fact, the fan blower figures everywhere as the only device adapted to secure these results.

It is manifest that the action must be positive, and of sufficient intensity to create ample movement of air where there is but little dust or the requirements of ventilation are slight, a fan applied for mere renewal of air throughout the entire extent of a room will meet the requirements.

FAN MAY FORM PART OF BLOWER HEATING SYSTEM

When warranted by the size of the plant the fan may form part of a blower heating system, by means of which warm air from a centralized heater is delivered under pressure through pipes to all parts of the building. In overheated rooms and particularly for summer ventilation the disc or propeller type of fan meets the requirements if placed in wall or ceiling.

Wherever dust or fumes are formed locally, as in connection with grinding and polishing wheels, tumbling barrels, or furnaces, the exhaust should be direct from hoods which enclose the objectionable source as completely as possible. In a word, prevention is better than cure. The objection which is often shown by workmen to hoods and similar contrivances—even to the extent of actual destruction—is largely due to their improper construction. In fact the cause for condemnation or criticism of many exhausting systems lies in the method of application of the fan, and not in the fan itself. The success of the fan not only depends upon its speed and its proper proportioning to the work, but also upon the system of piping and hoods which would give the greatest efficiency. It seems so simple to employ a local tinsmith to rig up an exhausting system that it is not strange that unsatisfactory conditions result.

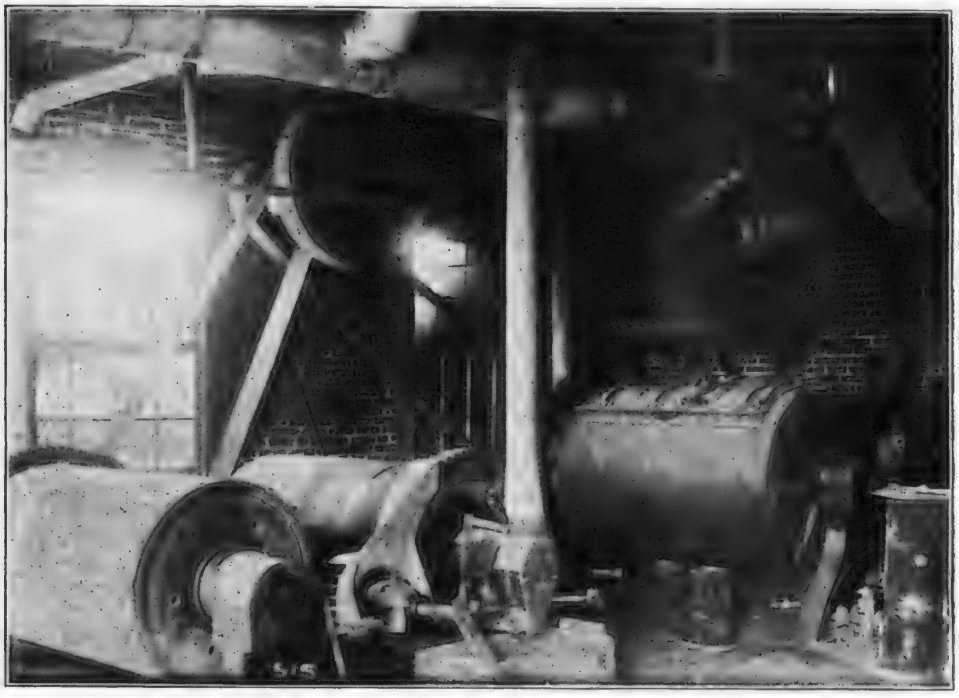
It is far better policy to secure the best advice, which will always be given by blower manufacturers, and then have the thing done right. It must not be overlooked that the installation of an economical exhausting arrangement requires definite engineering ability, and should only be undertaken by one who makes a specialty of this particular class of work.

ADVANTAGES OF LARGE SLOW-RUNNING FANS

Because of the lower first cost the user is always strongly tempted to buy the smallest apparatus that can be made to do the work. But first cost is only one of the factors in the total cost. Large slow-running fans with ample pipe areas are conducive to small power expenditures. It is easy to save enough in power in six months to pay the additional cost of a more efficient outfit or system. Thereafter its economy is all clear gain.

Even though the fan be of ample size when first installed it may, as a result of speeding up to meet added requirements, frequently demand from 50 to 100 per cent. more power than

would be necessary to do the work with a proper outfit. It is none too generally understood that the power required to drive a fan increases as the cube of the speed. In other words, that doubling the speed calls for an eight-fold increase in power, while 27 times the power is required at three times the speed; an increase of only 25 per cent. in speed calls for nearly double the power, and yet such an increase is common enough. How long would it take to pay for a new outfit from the money thus squandered in excessive power?



TRUNNION EXHAUST FROM TUMBLING BARRELS

DESIGN OF HOODS

The designs of hoods for grinding, polishing or buffing wheels are many and varied. Each must be arranged to suit the particular class of work for which the wheel is used. In some cases it is even necessary to have several different types in the same room. This is true where the pieces are of such shape and size that it is impossible to get very close to the wheel, the result being that at one time the operator uses the wheel at a point near the top, and again at a point directly underneath. Under these conditions especial care must be taken to provide the most effective type of hood and maintain the maximum blast. In heavy work of this type the air suction pipe should be 5 inches in diameter for wheels up to and including 16 inches in diameter by 3-inch face. In ordinary grinding and buffing rooms the suction pipes should be 4 inches in diameter for wheels $2\frac{1}{2}$ inches or less in width and from 10 to 18 inches in diameter. Wheels ranging from 19 to 28 inches should have 5 or 6 inches pipes, according to class of work for which they are used.

All hoods should be so designed that the velocity through the openings should not be less than 5,000 feet per minute, which is usually sufficient to create the draft necessary to carry away the particles. The best general type of hood is of patented form, provided with a receptacle below to trap out all heavy particles, as well as the threads from the buffing wheels, while allowing the finer dust to pass through the pipe. The result is that

the metallic particles are left in clean condition ready for resmelting, and the wear on the pipes and the fan is greatly reduced. This arrangement also prevents the annoyance caused by the dust from the rag wheel adhering to the fan wheel and throwing it out of balance. The trapping out feature, furthermore, permits of the ready recovery from the bottom of the hood of any small piece of work or other material, which with other types of hoods might get into the main trunk line or up into the fan.

All properly designed systems should have clean-out caps so as to provide free access to the interior of the piping for the removal of anything that might possibly tend to clog it. The main suction pipe should be proportionally increased in size as each connection is made to it.

To secure the most economical results a fan should be chosen which has an area of inlet about twice the combined area of the inlet pipes. This proportion will give the maximum velocity through the branch pipes and hoods. The fan should then be operated at about 1½ oz. speed, under which condition it would consume about ½ horsepower for each 4-inch opening.

The most work is done and consequently the most power is required by a fan when it is discharging with free inlet and outlet. The more extended the system of piping the smaller the area of inlet or outlet; and the greater the friction, the less will be the volume delivered by the fan; consequently, the less will be the power required to drive it. It is, therefore, manifest that the fact that the fan is consuming but little power is not always evidence of its successful operation, for it may be doing little effective work.

DISPOSAL OF DUST

The dust which is collected by the fan should be discharged into a centrifugal dust collector. Here the dust is separated from the air by centrifugal force; the air escapes from the top practically free from dust, while the dust itself drops out of the bottom through a pipe. It should be periodically removed. The dust from wheels grinding iron and steel should not be mixed with that from rag wheels, for in some cases fire will result. Separate fans and systems should be used.

EXHAUSTING FROM TUMBLING BARRELS

The same general principles hold in connection with systems exhausting from tumbling barrels. If the maximum effect of the fan is desired on tumbling barrels equipped with hollow trunnions, the area of fan inlet should be about double that of the sum of the openings in the trunnions. The sizes of pipes and the speeds o fans to be applied in connection with housed rattlers must depend largely upon the conditions, but a 6-inch pipe connection will usually serve for each tumbling barrel, if the same is tightly enclosed. A fan running at about 1 oz. speed will give sufficient draft.

No general rules can be given for the application of the fan system to sand blast rooms or apparatus. The arrangement must depend entirely upon the local conditions, but the provisions must be generous if successful results are to be obtained.

With installations such as are here described it is possible to maintain a relatively healthy atmosphere, which is bound to insure better work. Between the humanitarian spirit of the employer, the financial advantage of healthful conditions, and the requirements of the law, there is certainly no reason why healthful conditions should not be found wherever the brass industry is pursued.

McCarten Plumbing Co., Marshalltown, Iowa, altering heating system in the Pilgrim Hotel in Marshalltown.

Pearl B. Rutledge, Bellefontaine, Ohio, steam heating $55,000 high school building at that place.

Fitzpatrick & Hoepfner, Columbus, Ohio, heating and plumbing Hofman Jewelry Company's new building on North High street.

Dewstoe & Brainard Co., Cleveland, Ohio, heating and plumbing new building of the Royal Motor Car Co.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

Society's Annual Meeting Called for January 21, 22 and 23, 1908

Secretary William M. Mackay has issued the call for the fourteenth annual meeting of the Society, which will be held in the Engineering Societies' Building, 29 West 39th street, New York, January 21, 22 and 23, 1908. Members who desire to present papers for this meeting are asked to have them in the secretary's hands as soon as possible, as it is necessary to have them passed on by the Publication Committee, advance copies printed and forwarded to the members in time to allow them to prepare a discussion on them before the date of the meeting. It is a decided disauvantage to the authors as well as to the members to delay sending in a paper until a short time before the meeting. As the notice of the annual meeting was sent out September 27, members are given three full months in which to complete the preparation of their papers.

At a meeting of the Board of Governors September 20, when the date of the annual meeting was chosen, a committee was appointed to make nominations for the offices to be filled at the annual election.

The application of Nelson S. Thompson for advancement from junior to full membership was favorably acted upon. Eighteen new applications for membership were received, and a ballot containing the names of these candidates, as well as any others who wish to join the society, will be mailed to members in a week or two.

Information Wanted by the Committee on Fan-Blast Heating

The following questions have been sent out by the Committee on Fan Blast Heating, and answers are desired in time for the compilation of the committee's report, which will be made at the next annual meeting of the society in January next:

DATA RELATING TO HOT BLAST HEATERS REQUESTED BY COMMITTEE

1. What depth do you advocate making the coils in rows of pipe, for (1) outside air, (2) Return air for c, d. e, f: (a) Live steam, heating public buildings, (b) Exhaust steam, heating public buildings, (c) Live steam, heating factories, (d) Exhaust steam, heating factories; (e) Live steam for dry kilns, (f) Exhaust steam for dry kilns?

2. What is the maximum allowable velocity of air through a heater section as determined by you (a) for public buildings, (b) for factory buildings, (c) for dry kilns?

3. What temperature do you consider the air should be heated to, to give best results with a tempering coil?

4. How many rows of pipe do you allow for (a) tempering coil, (b) heater coil?

5. Do you advocate blowing through or "drawing" through a heater; where and why?

6. How do you determine the maximum temperature obtainable with varying depths of heaters, velocities and steam pressures?

7. How do you determine the heat units given off per square foot of heating surface per hour with varying initial temperatures and velocities of air, and steam pressures; also the condensation under same conditions?

8. What has been your experience with cast iron pipes or other indirect radiation besides pipe coils? (a) Has it been effective as a heating medium? (b) What is the comparative efficiency?

9. What type of radiation do you recommend for hot water heating (a) for gravity circulation, (b) for forced circulation by pump?

10. How do you compute the size of steam mains and returns for heaters supplied with steam at varying pressures; also for hot water circulation?

11. Do you regularly make provision for the removal of air from the radiation; if so, where and under what conditions of operation?

12. Do you make any addition to or deduction from the amount of radiation, as commonly determined by the rules or formulæ you employ, if any one of the several "vacuum systems" is attached to the heater?

Replies to the above questions should be addressed to Mr. William G. Snow, Penn Mutual Bldg., Boston, Mass., who is the chairman of the committee. The members of the committee are William G. Snow, chairman; R. C. Carpenter, J. H. Kinealy, F. A. Still and J. H. Brady.

British Institution of Heating and Ventilating Engineers

The Autumn meeting of the Institution of Heating and Ventilating Engineers was held at the hall of the Institution of Mechanical Engineers, Storey's Gate, London, October 8th last, in the evening. The programme included the election of president for the ensuing year.

The papers on the programme included one by C. R. Honiball on "The Heating and Ventilating of St. George's Hall, Liverpool," and one by J. Roger Preston on "Another Aid to the Ventilating Engineer: A Recording Anemometer."

Both of these papers will be found elsewhere in this issue of THE HEATING AND VENTILATING MAGAZINE.

NEW DEVICES

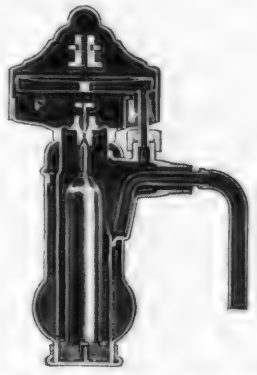
New Type of Norwall Air and Vacuum Valve

The latest developments in the construction of the Norwall automatic air and vacuum valve are illustrated in the accompanying sectional view, showing the valve open. This valve is made entirely of metal.

The venting part of the valve consists of a shell with the radiator connection so placed as to form a well in the lower part of the valve to receive and retain the water condensed from the steam as it passes into or through the valve. A sealed metal float is placed in this well. Surrounding this inner well or float chamber is the globe bottom air chamber, which is connected with the inner or float chamber by means of a small hole near the bottom of the inner shell. With the exception of this small hole the air chamber is hermetically sealed.

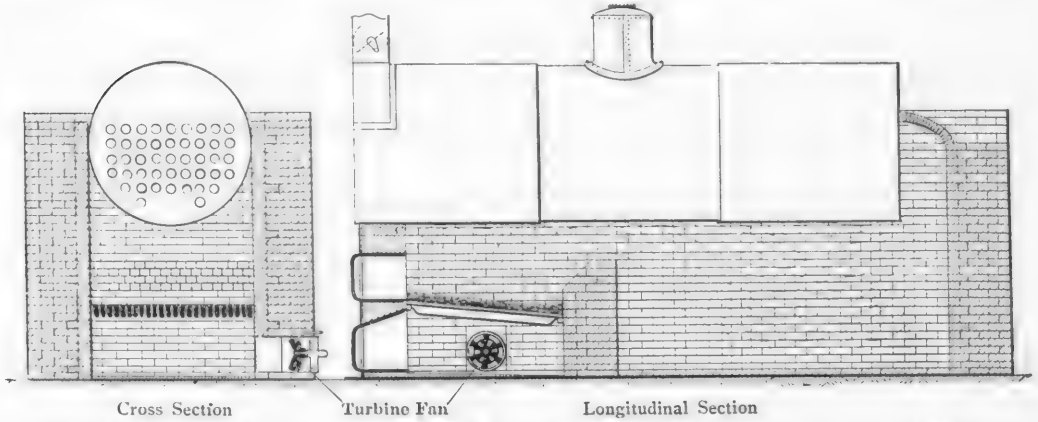
The vacuum or air sealing part of the valve consists of a double seat and upper and lower valve pins in the top of the inner or float shell. The lower valve pin is attached to the sealed metal float and engages the lower seat when the valve is closed by steam. The upper valve pin is attached to a yoke which in turn rests on the rod attached to the diaphragm. This upper valve pin is made to engage the upper seat by its own weight and its function is to prevent air from returning to the radiator through the air valve when steam is off. The motive power for lifting this upper valve pin and yoke to which it is attached is pressure within the radiator, which, passing through the small pipe attached to the radiator connection, enters the diaphragm chamber, shown in the cut, and lifts a special bronze diaphragm which unseats the upper valve pin.

When the valve is attached to the radiator and steam is turned on for the first time the pressure raises the diaphragm and unseats the upper valve pin, permitting the air in the radiator to pass freely through the valve. When steam enters the valve in this first operation it continues to pass through the



SECTIONAL VIEW OF NORWALL AUTOMATIC AIR AND VACUUM VALVE

valve for a few minutes until sufficient water is condensed in the inner or float chamber to carry the sealed metal float to its seat and thus close the valve against the further emission of steam. As soon as steam reaches the valve the air in the globe bottom air chamber expands and when steam goes off the air in this chamber cools and contracts and draws the water from the float chamber into the air chamber and the float being deprived of its support drops, thus opening the valve. When steam again enters the valve the water in the air chamber is forced by the expansion of the air into the float chamber and the valve closes almost instantly against the emis-



VIEWS OF BOILER EQUIPPED WITH WING TURBINE FAN FOR FORCED DRAFT

sion of steam. When pressure goes off the diaphragm being deprived of its support drops, allowing the upper valve pin to seat itself, closing the valve against the return of air to the radiator through the valve. The upper or diaphragm valve pin is always closed or seated when the pressure is less than ½ pound and always open or unseated when the pressure is ½ pound or over.

It frequently happens that a radiator while venting "works water," and under this condition the water surges against the air valve. The "Norwall" automatic air and vacuum valve, while freely venting the air from the radiator, instantly closes against water and remains closed as long as water remains against it. But the instant the water in the radiator falls away from the valve the syphon connection to the valve automatically discharges the surplus water back into the radiator and the valve recommences venting.

Typical Illustration of the Wing Turbine Fan for Forced Draft

In the accompanying illustration is shown a horizontal tubular boiler equipped with the new Wing steam turbine fan for forced draft. The fan is notable for the small amount of steam it requires for its operation. A detailed description of the turbine and fan was published in our June issue.

Heating Plant for Japanese Steel Works

An order has been recently placed with the makers of the Sirocco blowers for the complete heating plant to be installed in the new steel works now in course of erection in the north of Japan. The plant, one of the largest of its kind as yet supplied to Japan, includes ten separate heater sets, which are to provide heat for two large machine shops, measuring 600x130 ft. and 650x168 ft., respectively.

Each set comprises a large Sirocco multitubular air heater, and an electrically-driven centrifugal fan. The air heater consists of a central furnace from which the products of combustion are led through a series of tubes arranged horizontally on either side of same. The current of fresh air passes round the outside of the tubes, and there is no possibility of it becoming vitiated by coming into contact with the flue gases. Owing to the long distance the products of combustion have to travel before they reach the chimney, almost all the heat which can be obtained from the fuel is usefully applied in warming the air current, which makes it possible for these heaters to warm a large volume of air with an exceedingly low fuel consumption.

Attached to the heater is an electrically-driven Sirocco centrifugal fan, which draws the air through the heater and discharges it, warmed to a suitable degree, into the building.

With the system of heating which will be installed in the Japanese Steel Works no duct work is required, which means a considerable reduction in the first cost of a plant of this character, as well as a decided economy of valuable space. Further, the running cost of this system is low, owing to the fact that the fans are not propelling the warm air through ducts, which, by setting up resistance to the air current, increase the amount of power required to operate the fans.

In addition to the heating plant, the Japanese Steel Works has also ordered four Sirocco induced draft fans, 55 ins. in diameter, direct-coupled to electric motors. These fans are to deal with the flue gases from two batteries of boilers in the same works.

The Sirocco Engineering Company, of 138 Cedar street, New York, has during the past few years been importing their blowers from Belfast, Ireland, but arrangements have now been made, through the organization of an American company under same name, for the establishment of a plant at Troy, N. Y., for the complete manufacture in this country of all Sirocco apparatus, the new company having acquired exclusive rights under the United States, Canadian and Japanese patents, and sole business rights for North, Central and South America, West Indies, Hawaii, Philippines and Japan. The transfer of the business, which has already reached very considerable dimensions in the United States, took place as on October 1, 1907.

New Book

Principles of Heating, by William G. Snow, is an interesting contribution to the literature on this subject. At stated in its preface, the book is largely made up of articles by the author which have appeared in The Metal Worker. The columns of that journal are also drawn on for matter in addition to that written by the author.

Among the more notable chapters are those on the capacities of pipes in steam and hot water heating. In these the author presents a number of original tables which should prove of much value for reference purposes. Another interesting chapter deals with loss of heat by transmission, including charts prepared by the author.

The book closes with a chapter on vapor and vacuum systems of steam heating which, however, are not discussed critically, the author contenting himself with general descriptions. Pp. 161, including excellent index. Publishers, David Williams Co., New York. Price, $2.00.

TRADE AND MISCELLANEOUS NOTES

Deaths

Capt. B. N. Hurd, late of the J. L. Mott Iron Works, New York, and previously with the McCrum-Howell Co., New York, died September 22 at his home in Brooklyn, N. Y. Capt. Hurd was a well-known figure in the heating trade in the East.

Henry H. Fleck, president of Fleck Bros. Co., Philadelphia, manufacturers of plumbing supplies, was instantly killed September 17 by a train at Bala, Pa., where he lived. Mr. Fleck was at the time of his death first vice-president of the Eastern Supply Association. He was 39 years old. He leaves a widow and step-daughter.

New Firms

Maar Plumbing & Heating Co., 337 Main street, Poughkeepsie, N. Y., is a new firm of heating contractors.

Noonan Bros., 63 Mechanic street, New Rochelle, N. Y., have engaged in the heating and plumbing business. President, John Noonan; secretary-treasurer, Thos. Noonan.

Jordan Bros., 209 South Fourth avenue, Mt. Vernon, N. Y., is the title of a new heating and plumbing firm. David S. Jordan and William J. Jordan are the members of the firm.

Martin & Wigman, Wilner Building, Green Bay, Wis., has engaged in the heating business. Both members of the firm were formerly with Lewis & Kitchen, of Kansas City, Mo.

Grannis-Mason Engineering Co., San Francisco, Cal., is a new firm of heating and ventilating contractors located at 729 Polk street.

H. M. Baker, 435 South 14th street, Harrisburg, Pa., has engaged in the heating and plumbing business.

Belden-Porter-Gray Co., 704 Fifth street, South, Minneapolis, Minn., is a new firm of heating, ventilating and

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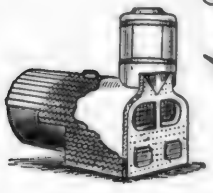

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plumbing contractors, succeeding W. I. Gray & Co.

Oswego Sanitary Plumbing Co., Oswego, N. Y., has engaged in the heating and plumbing business. The members of the firm are Frank D. Donovan and C. W. Dings.

Miscellaneous Notes

Central Heating Co., Milwaukee, Wis., subsidiary company of the Milwaukee Electric Railway & Light Co., has completed the construction of tunnels in the downtown portion of Milwaukee to contain steam pipes for heating that section of the city. There are nearly two miles of tunnels laid 17 ft. below the street level to avoid disintegrating effect on asphalt pavements, due to escaping steam.

Peterson Heat, Light & Power Co., Des Moines, Ia., is negotiating to install a hot water heating system in Springfield, Mo., for heating residences and business houses in that city, similar to the steam heating system now operated in the business district of Springfield.

Milwaukee, Wis.—City Attorney John C. Kelly has asked the State Railroad Rate Commission to fix the standard for the quality of heating and illuminating gas in Wisconsin. The application is the result of reports that the heating qualities of gas in Milwaukee has fallen below the standard of 600 B. T. U. per cubic foot. The standard of 600 B. T. U. for heating gas and 15-candle-power for illuminating gas was wiped out by the passage of the Public Utilities bill

Dickinson Electric & Light Co., Dickinson, N. D., is building a central heating plant to furnish steam for heating purposes to the business district of the city. The company guarantees to furnish steam heat at a cost not to exceed the price of fuel alone.

Milwaukee, Wis.—A strike of steam fitters was declared September 4 for an increase of 50 cents a day, making the scale $4.50.

Fowler Co., Waterloo, Ia., is building a heating plant at the rear of its wholesale houses on Lafayette street, of sufficient capacity to heat the company's block and furnish steam heat to other business buildings.

Andrews Heating Co., Minneapolis, Minn., suffered a loss by fire September 17, when its machine shop was damaged. The loss amounts to $1,000.

Madison, Wis.—Five public utility corporations have petitioned the State Railroad Commission for authority to increase their rates for furnishing steam heat.

Wooster, O.—The city council has granted to Clark et al. a franchise for establishing a central heating plant in that city.

Milwaukee, Wis.—Two thousand feet of piping in the streets, belonging to the old plant of the Pabst Power Co., has been abandoned, as it has become badly damaged by rust.

Portland Railway, Light & Power Co., Portland, Ore., has forfeited its steam-heating franchise on account of its failure to begin the laying of pipes within the time limit set by the ordinance.

Houghton, Mich.—A central heating plant will be installed to provide for buildings on north side of Sheldon street, between Dacotah and Quincy streets.

San Francisco, Cal.—F. A. Healy has renewed his petition to the Board of Supervisors for a franchise to lay mains and to install a hot water heating system in that city.

THE SCHOOL HOUSE, ITS HEATING AND VENTILATION

By JOSEPH A. MOORE, *Inspector of Public Buildings, State of Massachusetts*

The author having been for the last eighteen years engaged in the inspection of public buildings in Massachusetts, and in supervising the construction of and testing the various methods of heating and ventilation, especially in school houses, presents to those interested in our public schools some suggestions as to the construction and the heating and ventilation of such buildings. The class of buildings selected are those of small or moderate size, of which many are erected each year.

The author does not attempt to give theoretical or scientific descriptions or arguments, but simply such methods and plans as have been proved by actual experience to give satisfactory results.

Many of the plans were designed by the author for the annual official reports of the late Rufus R. Wade, chief of the Massachusetts district police.

The method of setting up indirect radiators, as shown in the plans and now generally adopted in Massachusetts, was designed by Mr. Moore, and first published in drawings which formed part of the official exhibit of the inspection department of the Massachusetts district police at the Columbian Exposition at Chicago in 1893, and for which an award was given.

Other plans formed part of the exhibit at the Paris Exposition in 1900, for which an award was also given, and at the Louisiana Purchase Exposition at St. Louis. **204 pages, illustrated. Price, $2.00**

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Harry B. Clow, secretary of Henry B. Clow & Sons, Chicago, Ill., has been elected president of the Rand, McNally & Co., publishers. Mr. Clow is a brother-in-law of the late Fred G. McNally, formerly president of the publishing house.

Manufacturers' Notes

National Radiator Co., Johnstown, Pa., announces the appointment of the Atlantic Supply Co., 1133 Broadway, New York, as its sales agents in western Connecticut, southeastern New York and northern New Jersey.

United States Radiator & Boiler Co., West Newton, Pa., suffered a loss by fire September 13, which partially destroyed its moulding room and foundry. The most valuable machinery and patents were saved. Loss, $60,000; fully insured.

Herendeen Mfg. Co., Geneva, N. Y., has completed the rebuilding of its plant. A new three-story warehouse has been added, equipped with modern apparatus for the rapid handling of the company's output.

William Powell Co., Cincinnati, O., will build an addition to its plant on a lot 37x200 ft., recently purchased.

William Clerkin, Akron, O., has purchased the plant of Taplin, Rice & Co., manufacturers of hot air furnaces. It is proposed to organize a company with $250,000, to manufacture furnaces and steam and hot water boilers.

Massachusetts Fan Co. has removed from Waltham to West Watertown, Mass., where it now occupies its new plant, consisting of three buildings, with a floor space of 28,000 sq. ft. With its enlarged quarters, the company will have five times the capacity of the former plant.

Carey Mfg. Co., Lockland, O., will build a new three-story structure, 100x400 ft., for the manufacture of asbestos pipe covering, and a new paper mill 100x300 ft.

Kelsey Heating Co., Syracuse, N. Y., has been given a favorable decision in the United States Circuit Court in the suit against the James Spear Stove & Heating Co., Philadelphia, for infringement on furnace patents owned by the Kelsey Heating Co.

Burt Mfg. Co., Akron, O., has increased its capital stock from $50,000 to $150,000.

Pressed Radiator Co., Pittsburg, Pa., announces that the Kinnear pressed radiators will be installed in the new 47-story Singer Building, New York; also in the Pacific Building, San Francisco, Cal., the largest reinforced concrete building in the world. In both cases the light weight of the Kinnear pressed radiators, as well as their other qualities, was an important factor. In the Singer Building the adoption of these radiators

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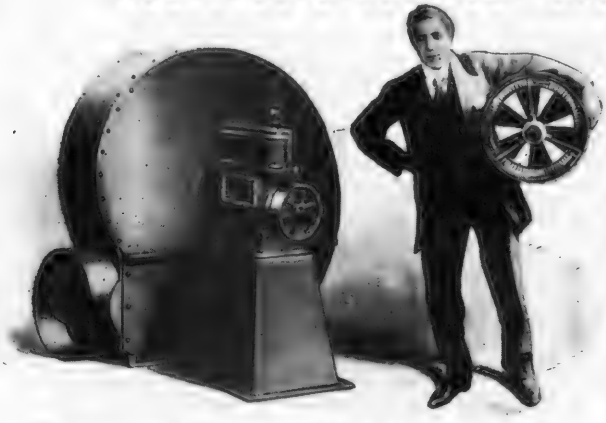

means guaranteed economy of fuel, increased boiler capacity, absolute simplicity.

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Mfrs. Wing's Disc Fans, Blowers and Exhaust Fans

Designers and Builders of Heating and Ventilating Systems

will relieve a weight in the tower alone of over 100 tons.

L. J. Wing Mfg. Co., West Street Building, New York, announces recent sales of the Wing turbine blowers for mechanical draft and disc fans, numbering over thirty important installations in New York and Brooklyn, and in Massachusetts, New Jersey and Ohio.

Business Troubles

Erie Heating Co., Chicago, Ill., was placed in the hands of a receiver September 7, and the American Trust & Savings Bank was named receiver. The creditors' petition charged that the president of the concern, Frederick A. Gale, had appropriated large sums of money from the assets of the company for his own use. On his examination, the amount of the sums diverted was stated to be $100,000. Among the creditors are the Crane Co., $3,480; Ball Engine Co., $2,644; and Kohler Bros., $541. The total liabilities are given as $35,000, and the assets nominal. The company was organized four years ago.

New Incorporations

Hoskins Electric Heating Co., Chicago, Ill., capital $130,000, to manufacture and deal in heating apparatus. Incorporators: E. F. Hoskins, Daniel Weber and Elmer E. Beach.

Hillpot Mfg. Co., Trenton, N. J., capital $25,000, to manufacture the Hillpot window ventilator. Among the stockholders are E. Furman Hooper, V. J. Willcox and Oliver J. Hillpot, of Riegelsville.

Mountain Light & Heating Co., Burlington, Vt., capital $15,000, to manufacture and deal in lighting and heating apparatus, and operating light and heating plants. The company will install gas heating and lighting plants in houses. Among the incorporators are the G. S. Blodgett Co., Dr. D. C. Hawley and J. B. Cobb, Jr., all of Burlington.

W. H. Williams Co., Chicago, Ill., capital $2,500, to conduct a heating and plumbing business.

Edwin Cutler Plumbing & Heating Co., Des Moines, Ia. Capital, $10,000. Incorporators: Edwin Cutler and Silas B. Allen.

Virginia Blower & Mfg. Co., Richmond, Va., capital $50,000, to manufacture and install blower systems for heating, ventilating, etc. President and treasurer, W. Pernet Pattison; A. J. Leitch, secretary and general manager.

Vulcan Foundry Co., Grand Rapids, Mich., capital $50,000, to manufacture and install the Peck hot water and steam

Zinc-Coated Steel Slip Nipples

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heaters, made heretofore by the Peck Heater Co., Syracuse, N. Y. President, Lewis T. Peck; vice-president, David Wolf; secretary and treasurer, M. H. Stimson.

Keller Steam Economizer Co., Joplin, Mo. Capital, $350,000. President, John R. Holmes; vice-president, John W. Moore; secretary and treasurer, Fred O. Small.

Allsop Heating Co., Brooklyn, N. Y. Capital, $3,000.

Andrews Engineering Co., New York, capital $10,000, to conduct a heating business. Incorporators: William Andrews, William F. H. Armstrong and Henry Pond, all of New York.

Utopia Heater Co., Detroit, Mich., capital $30,000, to manufacture heaters. Incorporators: Fred P. Obernauer, Edward H. McAllister and Louis C. Quinnin.

Acme Furnace Equipment Co., New York, capital $100,000, to manufacture engines, boilers, machinery, etc.

Cline Feed Water Heater Co., Camden, N. J., incorporated to manufacture feed water heaters and boilers. Incorporators: William Cline and J. K. Gibble, of Lancaster, Pa.; and W. B. Wolcott, Camden, N. J.

Heer Heating & Contracting Co., Baltimore, Md., incorporated to engage in steam and hot water heating. President and manager, Henry Heer; secretary, William J. Heer; treasurer, Bernhard U. Behrend.

Hampson-Nichols Co., Boston, Mass., recently incorporated, has taken the agency for the Crescent and Thayer heaters, now manufactured by the Gibby Foundry Co., East Boston. J. C. Nichols and William H. Hampson are associated in the new firm.

Chicago Heat, Power & Refrigeration Co., Chicago, Ill., has been incorporated. An ordinance granting a franchise to the company to lay pipes in connection with a central heating plant has been drawn up for presentation to the city council.

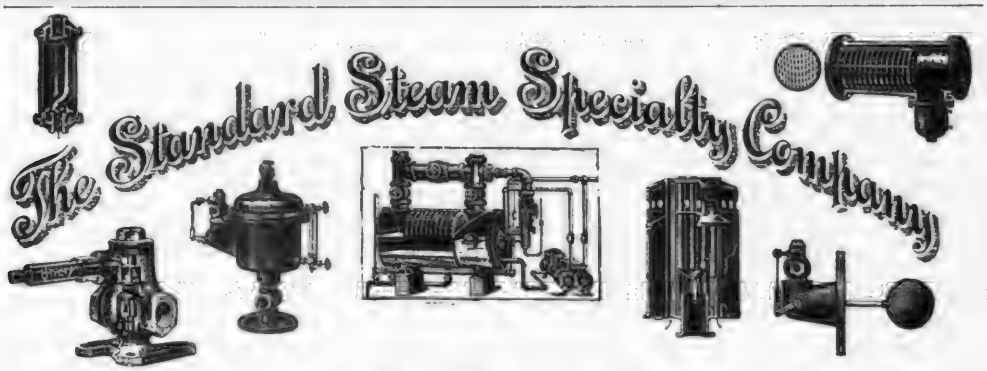
Business Changes

E. J. Ketcham Hardware Co., West Duluth, Minn., has added a heating and plumbing department to its business.

Midway Plumbing & Heating Co., St. Paul, Minn., has succeeded to the business of P. C. Peters. D. H. Shol is associated with Mr. Peters in the new company.

Business Chances

Washington, D. C.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Depart-



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ment, until 3 P. M., November 15, 1907, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the U. S. Post Office at Chippewa Falls, Wis.

Washington, D. C.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, until 3 P. M., November 5, 1907, for the construction (complete) of the U. S. Post Office at Flint, Mich.

Washington, D. C.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, until 3 P. M., October 28, 1907, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the U. S. Post Office and Court House at East St. Louis, Ill.

Washington, D. C.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, until 3 P. M., October 31, 1907, for the mechanical equipment (except elevators) of the U. S. Post Office, Custom House and Court House at Cleveland, Ohio.

Washington, D. C.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, until 3 P. M., October 18, 1907, for the extension, etc., to the U. S. Post Office and Court House at Denver, Colo.

Shamrock, Pa.—The Reformed and Lutheran congregations, worshipping in Longswamp Church, have decided to install a steam heating plant.

Milwaukee, Wis.—Price County Supervisors will install a new heating plant in the court house and county jail.

Faribault, Minn.—A new heating and ventilating plant will be installed in the Cathedral as soon as the brick chimney, now under construction, is completed.

Waukesa, Wis.—A legacy of $8,000 from the late Miss Jane Hutchinson is announced for the construction of a central heating plant at Nashotah House.

Oconto, Wis.—The Pierce House will be equipped this Fall with a hot water heating plant.

Monmouth, Ill.—A central heating plant will be installed at Monmouth College to heat the main college buildings, the new Carnegie Library, the auditorium and the gymnasium. Two boilers of 100-horse-power each will be installed, and the Webster vacuum system will be used.

Contracts Awarded

Frank Rawlings, Milroy, Minn., installing heating plant in the State Bank at Milroy.

W. H. Boone & Co., Calumet, Mich., heating plant for Y. M. C. A. building at Calumet. The contract price is $4.195.

James T. Kay, New Haven, Conn., heating Connecticut Telephone & Electric Co.'s new building in Meriden. The sprinkler system will be installed by the Foskett & Bishop Co., of New Haven.

W. D. Walker, North Yakima, Wash., steam heating and plumbing new High School building. Heating bid, $2,045; plumbing bid, $1,137.

Martin & Wigman, Green Bay, Wis., heating and ventilating system for First Ward school at De Pere; also heating and ventilating school building for the Church of Blessed Mary of the Angels.

Cuddy - Cavanaugh Co., New Ulm, Minn., heating plant for the new Roman Catholic church at Currie.

M. B. Sanders, Little Rock, Ark., steam heating plant for new City Hall at Little Rock. The work will cost $4,198.

Fargo Plumbing & Heating Co., Fargo, N. D., heating system for new High School building at Cooperstown. This company also has the contracts for heating the Kidder County Court House building at Steele, and Towney County

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Court House; also heating and ventilating school building at Corrington.

Campbell-Laird Heating Co., Minneapolis, Minn., heating new school building at Humboldt, also installing Campbell system of heating and ventilating in nine residences.

W. F. Powers, Guthrie, Okla., heating plant for new County Court House. The work will cost $3,200.

Sodemann Heat & Power Co., St. Louis, for steam heating, including vacuum system, for the Peabody Hotel, Memphis, Tenn.

Bradley Heating Co., St. Louis, steam heating Second Baptist Church and the Third National Bank building, St. Louis.

Peters-Eichler Co., St. Louis, installing steam heat, including Paul system, in the Lauram building, the Ely-Walker new department store, the Misval Realty Co.'s building, all in St. Louis, and the Hamilton-Brown shoe factory at Columbia, Mo.

O. C. Davis Co., Racine, Wis., steam fitting work at the Belle City Malleable Iron works of that city.

Elkhart Plumbing & Heating Co., Elkhart, Ind., heating new High School in Elkhart.

Paul System will be installed in the Pabst Brewing Co.'s buildings, and also in Gustave Pabst's residence in Milwaukee, Wis.

John B. Hughes Co., St. Louis, steam heating in a large addition to Mary Institute, Washington University, St. Louis.

Kelley & Bell, Aberdeen, S. D., the heating and plumbing of the New Sherman Hotel at Aberdeen.

Illinois Plumbing & Heating Co., steam heating, including vacuum system, of the new Supreme Court building at Springfield, Ill.

Kirkhoff Bros., Indianapolis, Ind., installing the Paul system in the Woman's Prison, a state institution in that city.

Conklin & Gustavson, Topeka, Kan., new heating plant in the remodeled National Hotel in that city.

H. Kelly Co., Minneapolis, steam heating, including the Paul system, in the residence of H. M. Hill, president of the Great Northern R. R.; also in the E. S. Woodworth and the Sam Thorpe residences.

American Heating Co., Duluth, steam heating for the new school at Two Harbors, Minn.

G. M. Parks Co., Fitchburg, Mass., steam heating plant in the Newport House, Newport, N. H. Also in new factory building of H. W. Goodrich, North Dana.

Newell Bros., Los Angeles, Cal., plumbing and heating the new chapel, library and dormitory at the Hollenbeck Home for $9,797.

Modern Heating Co., Wilkinsburg, Pa., steam heating system in the new Wilkinsburg National Bank building. Also in the $75,000 business and apartment building for W. F. Carnahan.

John Tierney, Altoona, Pa., plumbing and heating systems in the addition being built to the new Altoona High School.

A. B. Wheeler & Son, Wausau, Wis., remodeling heating and ventilating plant at the Court House.

J. D. Green, Urbana, Ill., plumbing and heating new Urbana Theater. The work will amount to $3,600.

Norwood & Ramsdell, Boston, Mass., ventilating system, boiler plant and other work in the New Algonquin Club.

Geo. Edmonson Co., New Haven, Conn., plumbing and steam heating building being erected on Church street for Chusker & Schroeder.

Dan. Hamilton, Webb City, Mo., plumbing and heating Post-office building. Contract price, $11,800.

O. S. Kendall & Son, Worcester, Mass., heating plants in three new buildings for the Memorial Hospital.

W. B. Kirk & Co., plumbing, heating, lighting and wiring new hospital building of the County Infirmary. Contract price, $2,132.18.

Stevens & Bradley, Manchester, N. H., steam heating and plumbing new Manchester Bank building.

Barrett & Wall, Hartford, Conn., hot water heating in residence of Mrs. Fredk. Jones; also steam heating sixteen-family house on Congress street for Attorney James Campbell.

Shields & Leadley, Lansing, Mich., heating plant in the City Hall.

J. P. Bisenius, St. Cloud, Minn., plumbing and heating new Jones building.

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F. A. Clegg & Co., Louisville, Ky., steam heating plant and electric lighting at the City Hall and annex in that city. Their bid was $24,556.

Finn Engineering Co., Altoona, Pa., heating Church of the Immaculate Conception; Thirteenth Street Methodist Church in Harrisburg; new theater being built in McKeesport for Dr. White; also plumbing and heating the new Marsh building and the new Roberts building at Altoona.

Healy Plumbing & Heating Co., St. Paul, Minn., plumbing and heating new Sherman Hotel.

Clefton Plumbing & Heating Co., Owatonna, Minn., plumbing and heating new Farmers' National Bank building at that place.

Barlow Bros. Co., Waterbury, Conn., steam heating Barnes School at Washington, Conn.; Driggs School in Waterbury, and the new Milford School in Milford.

M. J. Daly & Sons, Waterbury, Conn., installing 450-horse power plant, including boilers, pumps, engines and piping, in new power house of the American Ring Co.; also power piping in Libby, Swift & Co.'s meat house.

Whitten & Jackson, Boston, Mass., heating and ventilation in new Bray pavilion of the Newton Hospital at Newton, Mass.; addition to the Tremont Hotel on Jefferson street and the Odd Fellows building at Malden, Mass.

Ingalls & Kendricken, Boston, Mass., heating and ventiating systems for Franklin Union building.

P. F. Maginn & Co., Pittsburg, steam heating addition to First National Bank, Wilkinsburg, Pa.

Anderson - Darragh Co., Pittsburg, steam heating $14,000 residence for J. B. Rhodes at Sewickley, Pa.

D. E. Fluke, Nevada, Mo., plumbing and heating Vernon County Court House, $6,010.

William Plouff, Newburyport, Mass., steam heating Town Hall.

Stark Bros., Duluth, Minn., plumbing and heating new building for the Duluth Shoe Co.; also steam heating ten new buildings for the Clyde Iron Works.

Archambo Plumbing & Heating Co., Minneapolis, Minn., steam heating new building for the Self-Threading Needle Works; also heating Central Library.

Funkey Heating & Plumbing Co., Hancock, Mich., steam heating Gardner Building.

Frank Innes, Rhinelander, Wis., heating South Park School.

Hoffman Heating Co., Johnstown, Pa., heating apartment building at that place; also the Holsman Building at Cambria City.

John I. Dick, Scottdale, Pa., steam heating in Lynch Department Store at Uniontown.

Jones & Bagley, Superior, Neb., heating South School.

Fred. Smith & Co., Aurora, Ill., heating East Side School.

T. C. Brittingham, Augusta, Ga., heating and plumbing cotton mills at Bath and Clearwater.

J. A. Kloeb, Piqua, O., heating new Boal Apartments, for $1,755.

Avery-Thoman Plumbing Co., heating and plumbing new Majestic Theatre at Kalamazoo.

Oskaloosa Heating Co., Fonda, Ia., heating new public school building, for $2,980.

B. L. Seigh & Bro., Johnstown, Pa., heating and plumbing Roudebush Building on Franklin street.

Fitzpatrick & Hoepfner, Columbus, O., heating and ventilating annex to new High School, and overhauling heating system in old High School at Newark, O. The work will cost about $20,000.

J. T. Carmody, Cedar Rapids, Ia., heat-

30,000 HOMES
600 CHURCHES AND SCHOOLS
are being satisfactorily and economically heated by the
KELSEY
Warm Air Generator
SYSTEM
If you do not know all about the Kelsey, why not?
Send for Booklet and for 112 Page Book, "OPINIONS"
The Kelsey is unlike any furnace; warms fresh air by a better method; warms large volumes of air properly and forces into every room.
KELSEY HEATING COMPANY
307 Fayette St., Syracuse, N. Y. New York Office, 156 Fifth Ave.

ing plant for new High School in Newton.

McCullough Hardware Co., Monmouth, Ill., heating system for the new college building.

Balmat & Brayton, Carthage, N. Y., heating system in the Oswegatchie High School.

Geo. W. DeWolf, Fond du Lac, Wis., heating system in St. Mary's Catholic Church at Marytown.

J. J. Cardwell, Shenandoah, Ia., heating and plumbing systems in the Henry Field Seed House, for $2,000.

Little Falls Plumbing & Cycle Co., Little Falls, Minn., heating City Hall, for $935.

Purnell Hardware Co., Grand Rapids, Wis., hot water heating system in the Whittier Library at that place.

J. A. Devaney, Hastings, Minn., new heating plant in Court House, jail and sheriff's residence. Contract price, $4,485.

F. D. Grambs Plumbing & Heating Co., Dickinson, N. D., plumbing and heating Roman Catholic School building at Bismarck, for $2,428.

W. H. Boone Co., Laurium, Mich., plumbing and heating systems in the new Y. M. C. A. building at Calumet, Mich. Consideration, $4,000.

Bayley Heating Co., Milwaukee, heating new tuberculosis hospital for Milwaukee County.

Schirmer Bros., Chisholm, Minn., plumbing and heating in the O'Neil Hotel, $3,881; First National Bank building, $3,241, and the Gersin & Kovish building, $2,026.

Frank O. Houghton Co., Worcester, Mass., steam heating Home for the Aged at Worcester.

Lord & Burnham Co., Irvington, new greenhouse, including heating installation, for the Connecticut Agricultural College.

Minot Heating Co., Minot, N. D., heating and plumbing new school house at Minot.

Wyckoff & Lloyd Co., Springfield, Mass., heating and ventilating Wesson Hospital; also heating and plumbing Oak's Hotel, both in Holyoke.

Stewart & Hayden, Burlington, Ia., heating and plumbing Washington school building in Burlington.

Chafer Co., Cleveland, O., heating new school building at Wadsworth, O., for $7,800; also steam heating system for new Cuyahoga County Court House, to be equipped with the Paul system.

Huffman & Conkling, Columbus, O., heating and plumbing new school building at Wheelersburg, O.

WEBSTER W&C STEAM SPECIALTIES

Two Donkeys.

Steam heating systems are like the two peddlers with donkeys that wouldn't go. One tried to *push* his donkey along; the other held a cabbage before his donkey's nose. The

WEBSTER SYSTEM OF STEAM CIRCULATION

uses the cabbage plan. It puts a vacuum *ahead* of the steam, instead of pushing it with "back-pressure." The difference is not only in efficiency, but the vacuum plan saves immensely in cost, and obviates kicks, as in the donkey case.

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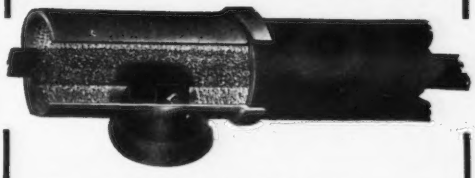
The Only Economical System of Insulation for Underground Pipes



When **Portland Sectional Conduit** is used, underground piping system is brought to the highest efficiency and economy.

Wood conduit soon rots, and, like brick tunnels, is highly inefficient.

Portland Sectional Conduit saves 88% of heat lost by bare or poorly insulated pipes; requires no maintenance; is permanently durable and will pay for itself in fuel saved in a few months.

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Milwaukee	Cleveland	Kansas City
Chicago	Buffalo	Minneapolis
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Philadelphia	San Francisco	Dallas
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J. B. McLardie, Dayton, O., hot water heating system for $60,000 residence in Dayton.

S. A. Esswein Heating & Plumbing Co., Columbus, O., hot blast heating and plumbing for repair shops of the Hocking Valley Railway Co. at Logan; also steam heating and plumbing $40,000 school building in Ashland.

W. B. Kirk & Co., Norwalk, Conn., steam heating and plumbing Huron County Infirmary Hospital.

Becker & Seidel Co., Cleveland, O., steam heating factory building for the Rauch & Lang Carriage Co.

Aberdeen Plumbing & Heating Co., Aberdeen, S. D., heating and plumbing the George W. Olney building.

Albert S. Trask, Concord, N. H., heating and plumbing New Hampshire State Hospital at Concord.

W. A. Bradford Co., Quincy, Mass., heating and plumbing Thomas Crane Library; also hot water heating Spargo Print building.

H. P. Cahill Plumbing Co., Akron, O., heating and plumbing Lake County Court House.

George E. Wharff, Bangor, Me., heating Larkin Street School.

Peters-Eichler Heating Co., St. Louis, Mo., central heating, lighting and ventilating plant for the Missouri State Penitentiary at Jefferson City, Mo.

Symms-Powers Co., Sioux Falls, S. D., heating new school in Worthington, Minn.

George E. Shearer, Cedar Falls, Ia., heating and plumbing new High School building at Ackley.

A. G. Pease Co., Spencer, Mass., steam heating Roman Catholic Church at that place.

Robert W. Kyle Co., Wheeling, W. Va., heating business and apartment building in Wheeling for J. H. Davidson.

David Bowers, Mt. Pleasant, Pa., steam heating $30,000 residence at that point.

Hamm Plumbing Co., Enid, Okla., heating plant for East Hill School, to cost $2,100.

George Thomas, Mt. Pleasant, Ia., heating County Infirmary, for $1,100.

Lewis & Kitchen, Kansas City, Mo., hot blast heating system for $125,000 Congregational Church at Kansas City.

Cotter-McDonnell Plumbing & Heating Co., Kansas City, Mo., steam heating New England National Bank building.

J. H. Kinealy's Works

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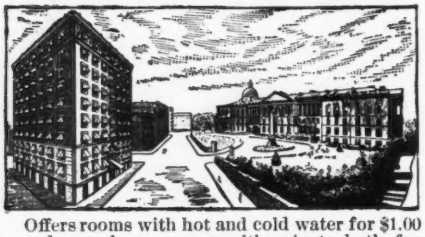

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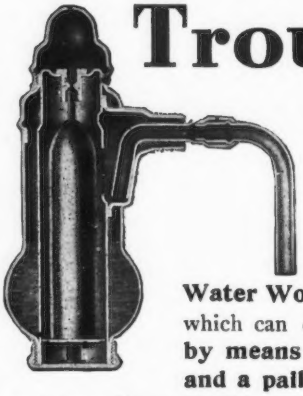
STORER F. CRAFTS, Manager

Trouble



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